US Army Corps
of Engineers
Omaha District

Annual Report - 1992
Tributary Reservoir Regulation Activities

(August 1991 - July 1992)

Prepared by:
Water Control Section
Hydrologic Engineering Branch
Engineering Division
Omaha, Nebraska

DECEMBER 1992

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
DEC 1992		**00-00-1992 to 00-00-1992**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Tributary Reservoir Regulation Activities (August 1991 - July 1992)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **U.S. Army Corps of Engineers,Omaha District,1616 Capital Avenue Ste 9000,Omaha,NE,68102**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a REPORT	b ABSTRACT	c THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**137**	

MISSOURI RIVER DIVISION
OMAHA DISTRICT
SUMMARY OF 1991-1992
RESERVOIR REGULATION ACTIVITIES

TABLES PAGE

FIGURES

APPENDIXES

REGULATION SHEETS FOR PAST YEAR
CORPS OF ENGINEERS PROJECTS (Continued)

REGULATION SHEETS FOR PAST YEAR
CORPS OF ENGINEERS PROJECTS (Continued)

NON-CORPS PROJECTS

This report is the Omaha District's portion of the Missouri River Division's 1991-1992 Annual Report on Reservoir Regulation Activities

MISSOURI RIVER DIVISION
OMAHA DISTRICT
SUMMARY OF 1991-1992

I. PURPOSE AND SCOPE. This annual report summarizes significant tributary reservoir regulation activities and tributary flooding within the geographic boundaries of the Omaha District. The period covered by this report is 1 August 1991 through 31 July 1992 and is referred to as the report period.

II. REFERENCES.

a. ER 1110-2-1400, 24 April 1970.

b. ER 1110-2-240, 8 October 1982.

c. Missouri River Division Letter, 1 October 1970, subject: Reservoir Regulation Reports.

III. RESERVOIRS IN THE OMAHA DISTRICT. The Omaha District, Corps of Engineers, civil works boundaries include 414,900 square miles that comprise the Missouri River watershed above Rulo, Nebraska.

a. Reservoirs with Flood Control Storage. There are 35 tributary reservoirs with allocated flood control storage covered in this report. The dams are listed below. Included are 24 Corps of Engineers dams and 11 Bureau of Reclamation dams. The locations of these 35 tributary reservoirs are shown in Appendix 1 and pertinent data are presented in Appendix 2. Appendix 3 summarizes chronologically the closure date for each of these tributary reservoirs and the six mainstem dams.

CORPS OF ENGINEERS DAMS

1. Bear Creek Dam, CO	13. Papillion No. 20, NE (Wehrspann)
2. Bowman-Haley Dam, ND	14. Pipestem Dam, ND
3. Bull Hook Dam, MT	15. Salt Creek No. 2, NE (Olive Creek)
4. Cedar Canyon Dam, SD	16. Salt Creek No. 4, NE (Blue Stem)
5. Chatfield Dam, CO	17. Salt Creek No. 8, NE (Wagon Train)
6. Cherry Creek Dam, CO	18. Salt Creek No. 9, NE (Stagecoach)
7. Coldbrook Dam, SD	19. Salt Creek No. 10, NE (Yankee Hill)
8. Cottonwood Springs Dam, SD	20. Salt Creek No. 12, NE (Conestoga)
9. Kelly Road Dam, CO	21. Salt Creek No. 13, NE (Twin)
10. Papillion No. 11, NE (Glenn Cunningham)	22. Salt Creek No. 14, NE (Pawnee)
11. Papillion No. 16, NE (Standing Bear)	23. Salt Creek No. 17, NE (Holmes Park)
12. Papillion No. 18, NE (Zorinski)	24. Salt Creek No. 18, NE (Branched Oak)

BUREAU OF RECLAMATION DAMS

1. Boysen Dam, WY	7. Keyhole Dam, WY
2. Canyon Ferry Dam, MT	8. Pactola Dam, SD
3. Clark Canyon Dam, MT	9. Shadehill Dam, SD
4. Glendo Dam, WY	10. Tiber Dam, MT
5. Heart Butte Dam, ND	11. Yellowtail Dam, MT

b. Reservoirs Without Flood Control Storage. There are two Corps of Engineers tributary lakes without allocated flood control storage included in this report. Both are subimpoundments of the Missouri River Main Stem Projects and were formed by the construction of relocations for transportation facilities and utilities. Lake Audubon, a subimpoundment of Lake Sakakawea, is located just northeast of Riverdale, North Dakota. Lake Audubon and Snake Creek Pumping Plant were to be major facilities of the Bureau of Reclamation's proposed Garrison Diversion Unit (GDU) Project. The GDU is presently being re-evaluated. While the project has not been deauthorized, it appears the scope of work will be scaled back. Lake Pocasse, a subimpoundment of Lake Oahe, is located near Pollock, South Dakota. The Bureau of Reclamation planned to use this lake as a regulating reservoir for the proposed Pollock-Herried Irrigation Unit. The development of this unit, however, has not materialized. Both lakes are used for fish and wildlife and recreational purposes. Their locations are shown on Appendix 1 and pertinent data are presented in Appendix 2.

IV. TRIBUTARY RUNOFF.

Tributary flows during the report period were below normal in most of the basin. Table 1 presents calculated percentages of normal runoff at pertinent locations within the basin. The Long Term Palmer Reports for Drought Severity from years 1988 through 1992 are shown on Figures 1 and 2. Table 2 lists peak discharges at selected gaging stations including many reservoir release control points used by the Omaha District.

Areas of extremely low runoff (less than 50% of normal) occurred in North Dakota, western South Dakota, eastern Nebraska, central Montana and central Colorado. Corresponding river basins are: the James (ND), Grand (ND), Knife (ND), Salt (NE), Upper Missouri (MT) and South Platte (CO).

Areas of 50% to 70% of normal runoff were in central Montana, central Wyoming, southwestern South Dakota and eastern Nebraska. River basins in these regions include the Marias (MT), Wind (WY), North Platte (WY), Cold Brook (SD), Papillion (NE) and Salt (NE).

River basins that experienced 71% to 100% of normal runoff were the Bighorn River basin in north central Wyoming, the Rapid Creek basin in western South Dakota, the Upper Missouri River basin in central Montana, the Salt Creek basin and the Papillion Creek basin in eastern Nebraska and the Bear Creek basin in central Colorado.

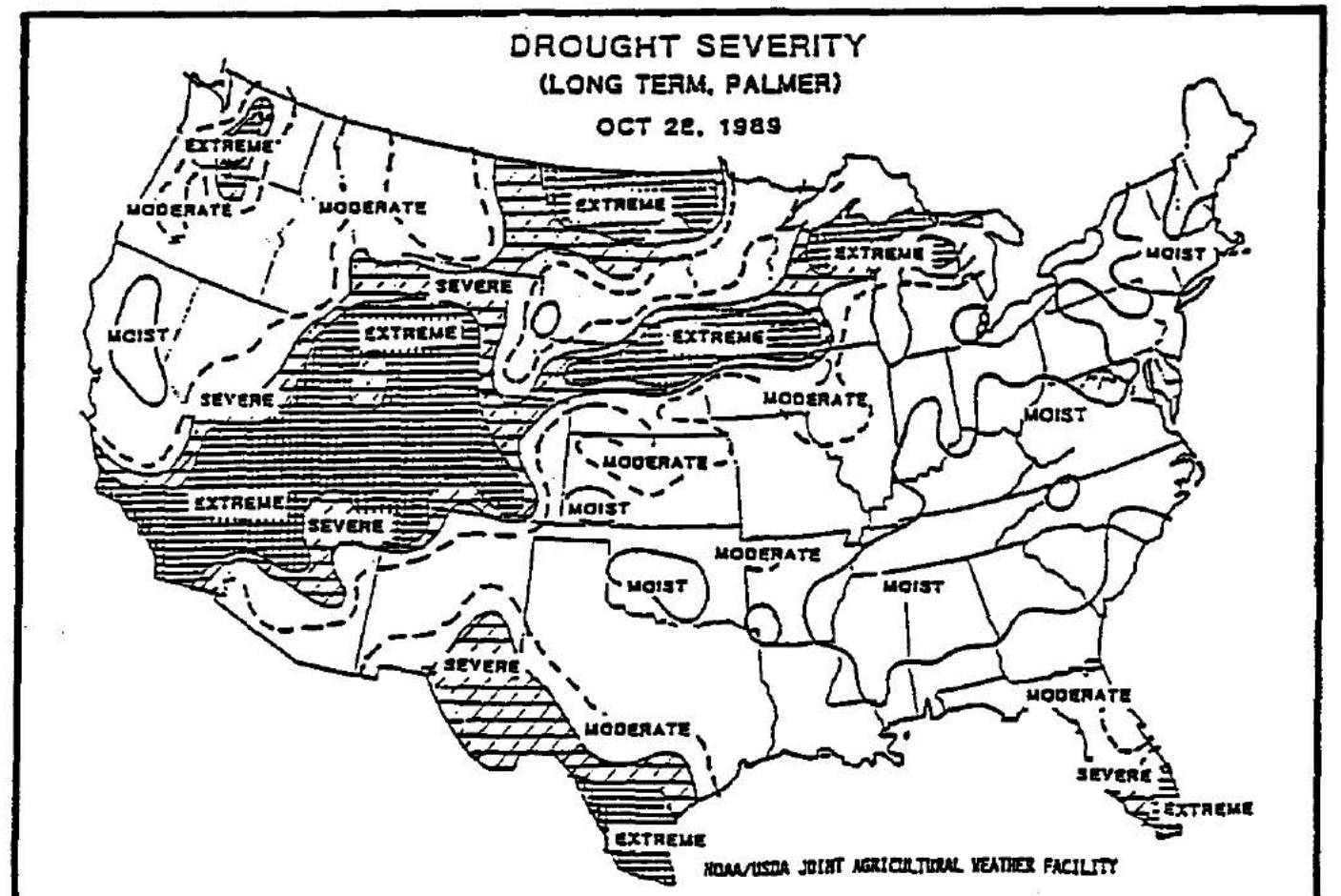
TABLE 1

Percentage of Normal Runoff
for
Report Period (August 1, 1991 to July 31, 1992)

PROJECT	INFLOW ACRE-FEET	AVERAGE INFLOW ACRE-FEET	% OF AVERAGE
CORPS OF ENGINEERS			
BOWMAN HALEY DAM	7,441	21,039	35
BEAR CREEK DAM	31,434	42,404	74
CHATFIELD DAM	81,724	187,060	44
CHERRY CREEK DAM	9,235	7,921	116
COLD BROOK DAM	352	575	61
PAPIO DAM 11	5,831	8,104	72
PAPIO DAM 16	379	1,158	61
PAPIO DAM 18	1,815 *	-----	--
PAPIO DAM 20	655	1,398	50
PIPESTEM DAM	7,747	24,867	31
SALT CREEK DAM 2	477	2,177	22
SALT CREEK DAM 4	2,509	3,950	64
SALT CREEK DAM 8	3,728	4,164	90
SALT CREEK DAM 9	1,975	2,688	73
SALT CREEK DAM 10	1,906	4,832	39
SALT CREEK DAM 12	843	6,233	14
SALT CREEK DAM 13	1,241	4,106	29
SALT CREEK DAM 14	3,309	8,313	40
SALT CREEK DAM 17	2,245	2,371	95
SALT CREEK DAM 18	10,526	29,842	35
TOTAL:	**173,527 ****	**363,202**	**48**
BUREAU OF RECLAMATION			
BOYSEN DAM	672,350	1,072,598	63
CANYON FERRY DAM	3,152,900	4,144,360	76
CLARK CANYON DAM	140,270	304,339	46
GLENDO DAM	810,081	1,262,582	64
HEART BUTTE DAM	12,451	94,965	13
JAMESTOWN DAM	1,836	29,390	6
KEYHOLE DAM	7,155	33,222	22
PACTOLA DAM	23,670	33,474	71
SHADEHILL DAM	20,129	74,136	27
TIBER DAM	350,170	680,652	51
YELLOWTAIL DAM	2,061,010	2,647,645	78
TOTAL:	**7,252,022**	**10,377,363**	**70**

* **Dam closed 7 Dec 89 - no averages computed**

** **Does not include Papio Dam 18**


DROUGHT SEVERITY
(LONG TERM, PALMER)
OCT 22, 1989
EXTREME
MODERATE
MODERATE
EXTREME
EXTREME
MOIST
SEVERE
MOIST
EXTREME
EXTREME
SEVERE
MODERATE
MOIST
MODERATE
EXTREME
SEVERE
MOIST
MODERATE
MOIST
MOIST
SEVERE
MODERATE
MODERATE
SEVERE
EXTREME
EXTREME
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

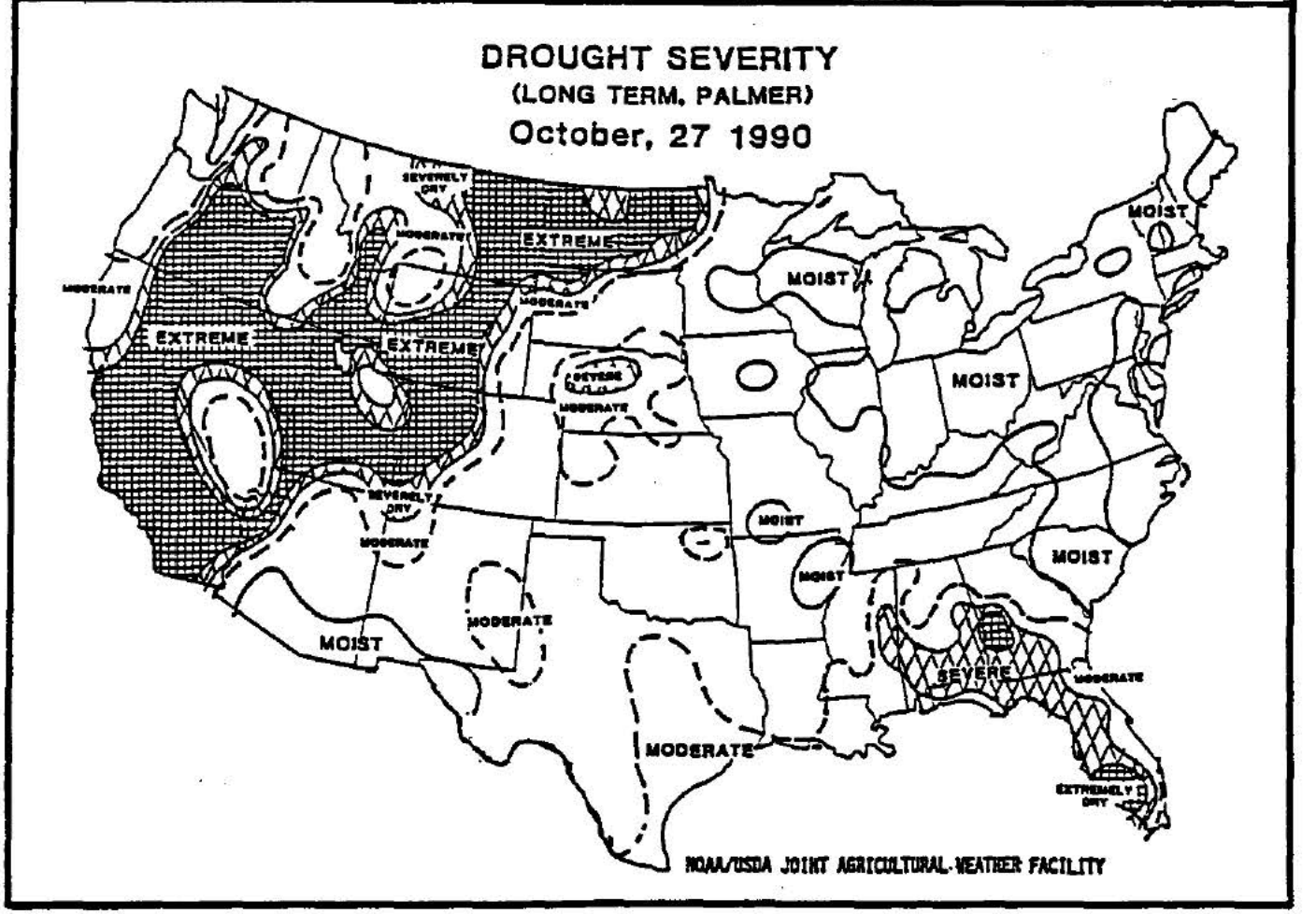
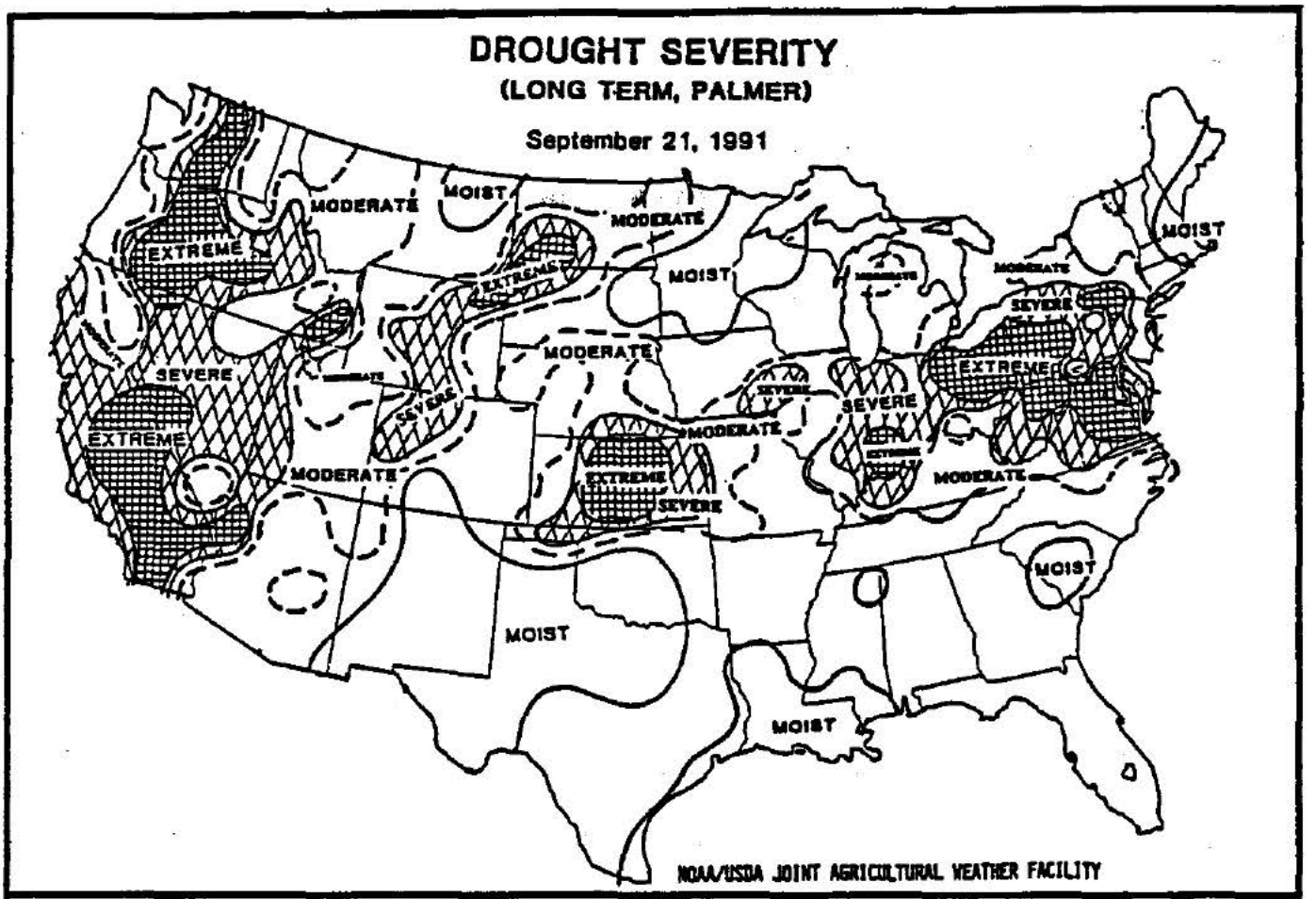

DROUGHT SEVERITY
(LONG TERM, PALMER)
October, 27 1990
SEVERELY DRY
MODERATE
EXTREME
MOIST
MOIST
MODERATE
MODERATE
EXTREME
EXTREME
SEVERE
MODERATE
MOIST
SEVERELY DRY
MODERATE
MOIST
MOIST
MOIST
MODERATE
MOIST
SEVERE
MODERATE
MODERATE
EXTREMELY DRY
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

FIGURE 1


DROUGHT SEVERITY
(LONG TERM, PALMER)
September 21, 1991
EXTREME
SEVERE
MODERATE
MOIST
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

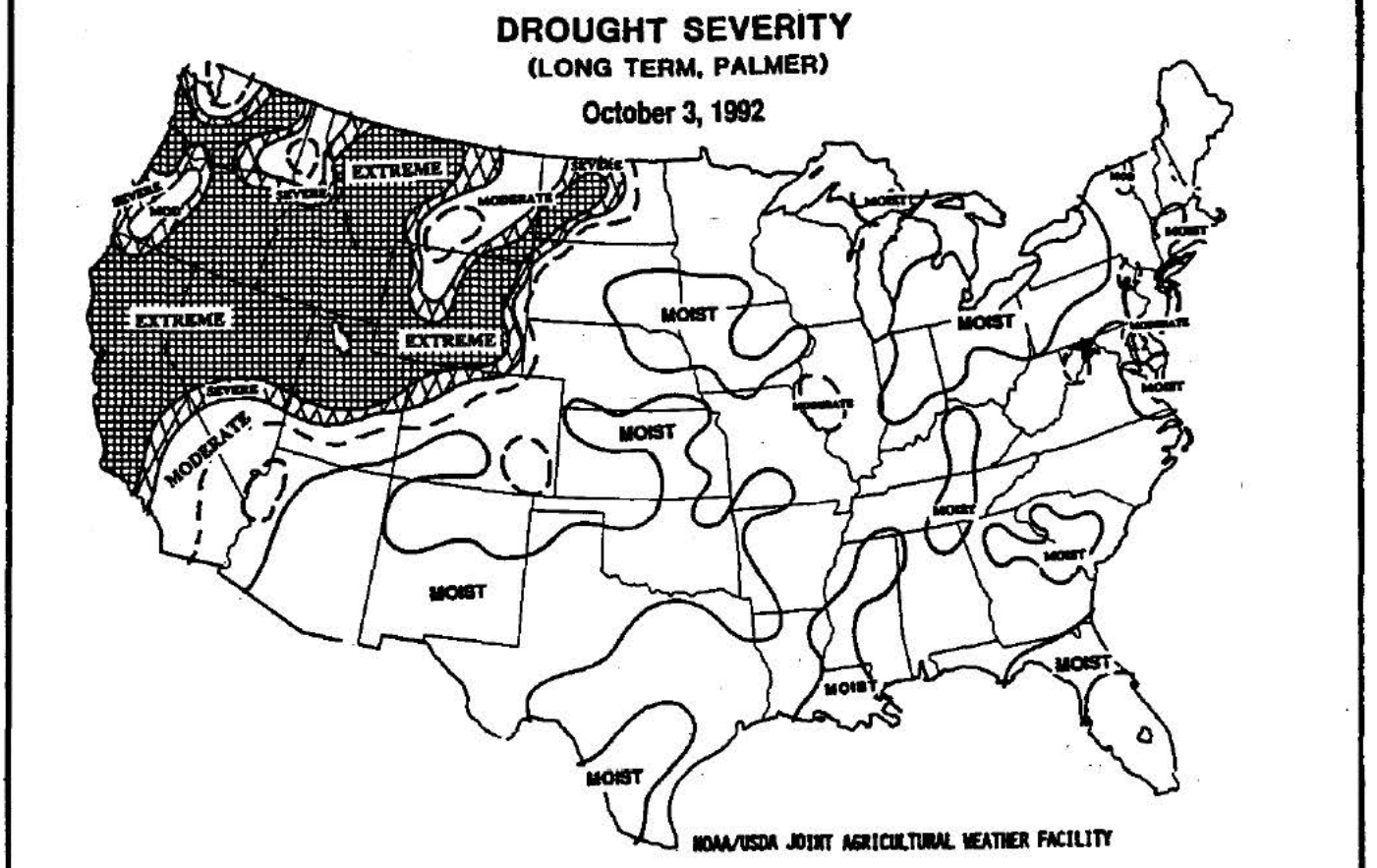

DROUGHT SEVERITY
(LONG TERM, PALMER)
October 3, 1992
EXTREME
SEVERE
MODERATE
MOIST
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY

FIGURE 2

TABLE 2

PERTINENT 1992 WY PROVISIONAL PEAK DISCHARGES (C.F.S.)

STREAM	STATION	DRAINAGE AREA (SQ. MILES)	PERIOD OF RECORD (YEARS)	FLOOD STAGE (FEET)	Maximum 1992 DATE	Maximum 1992 STAGE (FEET)	Maximum 1992 DISCHARGE (CFS)	Maximum Known Flood DATE	Maximum Known Flood STAGE (FEET)	Maximum Known Flood DISCHARGE (CFS)	
Red Rock River	Blw. Lima Res., MT	570	69	1.1	MAY 25 1992	3.67	686	15 MAY 1933	6.40	2,500	
Milk River	At Havre, MT.	5,785	66	10.0	MAY 08 1992	6.01	1,650	12 APR 1899	19.30	20,000	A
Milk River	Nr. Saco, MT.	17,670	15	20.0	AUG 17 1991	3.91	464	03 APR 1978	24.20	12,400	C
Milk River	At Nashua, MT.	22,332	53	20.0	JUN 18 1992	3.30	523	18 APR 1952	31.38	45,300	
Missouri River	Nr. Wolf Point, MT.	82,290	64	10.9	APR 19 1992	3.10	9,250	25 MAR 1939	14.40	66,800	D
Wind River	Riverton, WY.	2,309	84	8.0	JUN 28 1992	6.62	2,870	15 JUN 1935	10.15	13,300	E
Little Wind River	Nr. Riverton, WY.	1,904	51	10.0	JUL 02 1992	5.16	1,820	17 JUN 1963	10.85	14,700	
Wind River	Blw. Boysen Res., WY.	7,701	41	N/A	SEP 21 1991	5.39	1,710	07 JUL 1967	13.35	13,500	
Big Horn River	At Kane, WY.	15,765	63	8.0	JUN 16 1992	5.70	9,060	16 JUN 1935	11.10	25,200	
Yellowstone River	At Miles City, MT.	48,253	65	13.0	JUN 19 1992	9.51	39,400	22 MAY 1978	16.50	102,000	
Missouri River	At Bismarck, N.D.	186,400	65	16.0	FEB 02 1992	11.05	24,200	06 APR 1952	27.90	500,000	B,F,G
N. Fork Grand River	At Haley, N.D.	509	57	17.0	JUN 13 1992	6.67	90	07 APR 1952	17.03	14,100	H
Fall River	At Hot Springs, S.D.	137	55	13.0	JUN 26 1992	3.65	179	04 SEP 1938	18.40	13,100	A
Rapid Creek	At Rapid City, S.D.	410	56	7.0	JUL 03 1992	5.02	263	09 JUN 1972	19.66	50,000	
Belle Fourche River	At. WY.-S.D. State Line	3,280	46	14.0	SEP 09 1991	4.47	143	18 JUN 1962	15.59	4,400	
Pipestem Creek	Nr. Pingree, N.D.	700	19	10.0	MAR 09 1992	6.61	178	20 APR 1979	11.60	2,520	B,I
James River	Nr. Grace City, N.D.	1,060	24	12.0	MAR 07 1992	6.99	350	13 MAY 1969	12.00	3,100	B
James River	At Jamestown, N.D.	2,820	58	12.0	MAR 17 1992	4.41	130	13 MAY 1950	15.82	6,390	A,B
James River	At LaMoure, N.D.	4,390	43	14.0	MAR 21 1992	6.78	166	14 APR 1969	16.17	6,800	
James River	At Columbia, S.D.	5,857	47	11.0	JUL 04 1992	5.63	30	24,25 MAY 1950	16.89	5,420	J
James River	At Ashton, S.D.	9,742	47	13.0	JUL 01 1992	7.24	360	24 APR 1969	20.63	5,680	K
James River	Nr. Scotland, S.D.	20,653	64	13.0	JUL 13 1992	6.74	760	23 JUN 1984	20.45	29,400	
Vermillion River	Nr. Vermillion, S.D.	2,302	9	21.0	JUL 13 1992	10.25	551	23 JUN 1984	31.77	21,400	
Big Sioux River	At Akron, IA.	8,424	64	16.0	JUL 06 1992	18.00	8,780	09 APR 1969	22.99	80,800	
Missouri River	At Sioux City, IA.	314,600	95	36.0	JUL 12 1992	19.90	36,500	14 APR 1952	24.28	441,000	A
Little Sioux River	Nr. Turin, IA.	3,526	34	20.0	JUL 14 1992	17.64	10,500	21 JUN 1983	26.54	31,200	L
Big Papio Creek	Fort Crook, NE.	384	44	29.0	AUG 07 1992	26.20	6,130	21 MAY 1982	30.68	12,700	A,M
Missouri River	At Omaha, NE.	322,800	64	29.0	JUL 15 1992	21.21	50,800	18 APR 1952	40.20	396,000	
North Platte River	Nr. Sinclair, WY.	4,175	53	4.9	MAY 28 1992	5.17	3,800	11 JUN 1986	11.30	16,200	
North Platte River	Blw. Whalen Diversion, WY	16,425	83	4.5	JUL 01 1992	4.22	2,190	26 JUN 1955	9.85	22,000	
Laramie River	Nr. Ft. Laramie, WY.	4,564	77	6.5	JUL 01 1992	3.36	332	10 MAY 1973	9.40	6,260	
North Platte River	At Wy.-Neb. State Line	22,218	63	4.5	AUG 03 1992	3.26	1,360	02 JUN 1929	7.04	17,900	
North Platte River	At Bridgeport, NE.	25,300	87	8.0	SEP 24 1991	7.69	1,660	26 JUN 1899	5.39	24,900	A
North Platte River	At Lewellen, NE.	28,600	53	7.0	SEP 25 1991	5.44	1,510	04 JUN 1971	NR	13,500	
North Platte River	At North Platte, NE.	30,900	97	7.0	JUL 12 1992	4.02	1,190	11 JUN 1909	NR	29,600	
South Platte River	At Waterton, CO.	2,621	64	6.0	JUN 04 1992	1.59	361	23 APR 1942	5.68	5,700	
Bear Creek	At Morrison, CO.	164	75	7.5	JUN 27 1992	4.82	123	24 JUL 1896	NR	8,600	
South Platte River	At Denver, CO.	3,861	99	9.0	MAR 04 1992	6.52	3,405	17 JUN 1965	18.66	40,300	
Clear Creek	At Derby, CO.	575	76	8.0	JUL 26 1992	2.38	369	24 JUL 1965	8.97	5,070	
South Platte River	At Henderson, CO.	4,713	66	11.0	MAR 04 1992	7.42	6,240	06 MAY 1973	11.67	33,000	N
South Platte River	Nr. Kersey, CO.	9,598	90	10.0	AUG 04 1992	6.61	4,420	08 MAY 1973	11.73	31,500	
South Platte River	At Julesburg, CO.	23,193	90	10.0	MAR 22 1992	5.36	1,950	20 JUN 1965	10.44	37,600	O
South Platte River	At North Platte, NE.	24,300	78	12.0	MAR 20 1992	2.98	983	03 JUN 1935	14.02	37,100	
Platte River	At Brady, NE.	56,200	55	5.0	JUL 01 1992	2.69	989	29 JUN 1983	NR	23,500	
Platte River	Nr. Grand Island, NE.	58,800	59	4.0	JUL 25 1992	2.72	2,680	06 JUN 1935	5.99	30,000	P
Elkhorn River	At Waterloo, NE.	6,900	73	17.0	JUN 17 1992	11.53	18,900	12 JUN 1944	16.60	100,000	A

TABLE 2 (Continued)

PERTINENT 1992 WY PROVISIONAL PEAK DISCHARGES (C.F.S.) (Continued)

STREAM	STATION	DRAINAGE AREA (SQ. MILES)	PERIOD OF RECORD (YEARS)	FLOOD STAGE (FEET)	Maximum 1991 DATE	Maximum 1991 STAGE (FEET)	Maximum 1991 DISCHARGE (CFS)	Maximum Known Flood DATE	Maximum Known Flood STAGE (FEET)	Maximum Known Flood DISCHARGE (CFS)	
Salt Creek	At Lincoln, NE.	684	43	20.5	JUN 13 1992	9.84	2,890	02 JUN 1951	26.15	28,200	
Salt Creek	At Greenwood, NE.	1,051	41	20.0	JUN 13 1992	11.67	8,900	13 JUN 1984	26.50	46,800	
Platte River	At Louisville, NE.	85,800	37	9.0	JUN 17 1992	7.11	32,500	14 JUN 1984	11.34	144,000	Q
Missouri River	At Nebraska City, NE.	410,000	63	18.0	JUN 18 1992	13.78	55,000	18,19 APR 1952	27.66	414,000	
West Nishnabotna	At Randolph, IA.	1,326	44	19.0	JUL 30 1992	12.97	3,830	26 MAY 1987	24.50	40,800	R
East Nishnabotna	At Red Oak, IA.	894	64	18.0	JUL 30 1992	14.47	6,930	13 SEP 1972	27.43	38,000	S
Nishnabotna River	Above Hamburg, IA.	2,806	66	16.0	JUL 31 1992	20.81	11,100	24 JUN 1947	26.03	55,500	T
Missouri River	At Rulo, NE.	414,900	43	17.0	JUL 30 1992	20.53	87,000	22 APR 1952	25.60	358,000	

A) Site and datum then in use.
B) 1992 Water year peak was ice affected
C) Maximum gage height = 26.70 feet on March 4, 1986 due to ice effect
D) Maximum gage height for the water year occured on December 17 - ice affected
E) Maximum gage height = 10.80 feet on December 30, 1983
F) Maximum discharge prior to Garrison Dam (1953)
G) Since Garrison Dam:Max discharge = 68,900 c.f.s.;July 13, 1975;14.24 feet
H) Maximum gage height = 17.10 on April 15,1950
I) Maximum of record ice affected
J) Maximum gage height = 17.11 feet on March 24, 1987
K) Maximum gage height = 21.17 feet on April 13, 1969 (backwater from Snake Creek)
L) Maximum gage height = 27.44 feet on February 19,1971 - backwater from ice
M) Estimated stage at top of levee is approximately 40 feet
N) Maximum gage height = 12.93 feet on June 17, 1965
O) Discharge is combined flow for channels 1,2,3 and 4. Maximum gage height occured in channel 1 & 2.
P) Maximum gage height = 6.16 on March 27,1960 - backwater from ice
Q) Maximum gage height = 12.45 on March 30,1960
R) Maximum gage height = 24.8 feet on March 5, 1949 due to backwater from ice
S) Maximum gage height = 28.23 feet on June 13, 1947
T) Maximum gage height = 28.27 on September 10, 1989

TABLE 2 (Continued)

The only region that experienced more than 100% of normal runoff was the Cherry Creek basin in central Colorado.

V. RESERVOIR ACCOMPLISHMENTS.

a. Flood Damages Prevented.

Flood damages prevented by Corps of Engineers and Bureau of Reclamation projects in FY92 and cumulative totals of flood damage prevented for each of the projects are summarized in Table 3.

b. Recreation Usage. Visitation hours for each project for FY91 and FY92 are tabulated in Table 4.

VI. RESERVOIR OPERATION. Actual operations for the past year and proposed operations through calendar year 1992 are discussed briefly in the following subsections. Individual project operation summaries are contained in Appendix 4. A tabulation of the number of cases that the exclusive flood control zones in the 35 Omaha District tributary reservoirs have been filled to 25, 50, 75 and 100 percent is shown on Table 5. Most of the near capacity pools occurred at the Section 7 Bureau of Reclamation projects.

a. Previous Years Operation (August 1, 1991 through July 31, 1992.)

(1) Corps of Engineers Lakes. All Corps' tributary projects within the Omaha District were regulated in accordance with normal procedures during the period covered by this report. Bear Creek, Chatfield, Cherry Creek, Papio #11, Papio #18, Pipestem, Salt Creek #4, #8, #9, #10, #14, #17 and #18 stored water in the flood storage zone or above their normal level at some time during the reporting period. A new low pool of record was established at Bowman Haley Dam.

(a) Bear Creek Reservoir, Colorado. During the report period, the district renewed the two temporary one year municipal and industrial water supply storage contracts for a total of 74 acre feet under Section 6 of the Flood Control Act of 1944 (Public Law 534, 78th Congress), pending development of a long-term contract under the Water Supply Act of 1958, as amended. A revised Memorandum of Understanding (MOU) between the Corps of Engineers and the State of Colorado was signed on June 20, 1988, superseding the previous MOU dated May 11, 1977. Under the revised MOU, the State Engineer or his representative will determine the storage and releases necessary to satisfy downstream water rights requirements when the pool level is below elevation 5559.0 ft. MSL. This target elevation encroaches one foot into the flood storage zone and was selected to allow flexibility in targeting authorized pool levels. During the reporting period, no requests were received to change to continuous gated regulation to store water per the contract.

TABLE 3

FLOOD DAMAGES PREVENTED FY 1992
CORPS OF ENGINEERS, OMAHA DISTRICT PROJECTS
LOCAL AND MAIN STEM REDUCTIONS ($000)

OCTOBER 1992

SOURCE: WORK SHEETS

Omaha District Projects	Reach Location	Cumulative Thru FY 91	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	Total FY 1992	Cumulative Thru FY 92
Missouri River Reservoirs	MRO	1,035,076.4	0.0	0.0	0.0	8,106.0	0.0	0.0	8,106.0	1,043,182.4
Other Reservoirs										
Aurora	CO	2,172.0				5,241.2			5,241.2	7,413.2
Bear Creek Dam	CO	450.0					2,107.5		2,107.5	2,557.5
Bowman-Haley	ND/SD	1,838.0			4,545.8				4,545.8	6,383.8
Chatfield	CO	1,945.0					8,772.5		8,772.5	10,717.5
Cottonwood Springs	SD	0.0							0.0	0.0
Cherry Creek Dam	CO	163,267.0					252.8		252.8	163,519.8
Coldbrook Dam	SD	0.0							0.0	0.0
Papillion Creek	NE	3,010.8							0.0	3,010.8
Pipestem	ND	13,683.6							0.0	13,683.6
Salt Creek Dams	NE	45,811.6							0.0	45,811.6
Subtotal:		232,178.0	0.0	0.0	4,545.8	5,241.2	11,132.8	0.0	20,919.8	253,097.8
Missouri River Levee System										
L-601	IA	68,184.9	0.0	0.0	0.0	485.4	0.0	0.0	485.4	68,670.3
L-594	IA	48,495.9	0.0	0.0	0.0	343.3	0.0	0.0	343.3	48,839.2
L-575	IA/MO	66,885.1	0.0	0.0	0.0	1,372.5	0.0	0.0	1,372.5	68,257.6
L-561/L-550	MO	54,991.4	0.0	0.0	0.0	1,172.7	0.0	0.0	1,172.7	56,164.1
L-536	MO	15,175.7	0.0	0.0	0.0	321.0	0.0	0.0	321.0	15,496.7
R-613	NE	14,816.3	0.0	0.0	0.0	106.6	0.0	0.0	106.6	14,922.9
R-573	NE	2,807.0	0.0	0.0	0.0	59.0	0.0	0.0	59.0	2,866.0
R-562	NE	8,515.3	0.0	0.0	0.0	183.4	0.0	0.0	183.4	8,698.7
R-548	NE	6,069.4	0.0	0.0	0.0	127.8	0.0	0.0	127.8	6,197.2
R-520	NE	1,789.8	0.0	0.0	0.0	39.3	0.0	0.0	39.3	1,829.1
Subtotal:		287,730.8	0.0	0.0	0.0	4,211.1	0.0	0.0	4,211.1	291,941.9
Local Protection Projects										
Belle Fourche	SD	380.0							0.0	380.0
Big Sioux River	IA	0.0							0.0	0.0
Blackbird Creek	NE	269.0							0.0	269.0
Broken Bow	NE	108.0							0.0	108.0
Clarkson	NE	670.9							0.0	670.9
Columbus	NE	1,709.0							0.0	1,709.0
Council Bluffs	IA	397,993.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	397,993.0 *
Emerson	IA	0.0							0.0	0.0
Floyd River	IA	27,441.0							0.0	27,441.0
Forsyth	MT	1,849.1							0.0	1,849.1
Gering	NE	520.0							0.0	520.0
Glasgow	MT	1,326.0							0.0	1,326.0
Great Falls	MT	0.0							0.0	0.0
Greybull	WY	4,345.0							0.0	4,345.0
Hamburg	IA	71,289.5							0.0	71,289.5
Havre	MT	20,664.0				3,366.7			3,366.7	24,030.7
Hawarden	IA	552.0							0.0	552.0

TABLE 3 (Cont)

FLOOD DAMAGES PREVENTED FY 1992
CORPS OF ENGINEERS, OMAHA DISTRICT PROJECTS
LOCAL AND MAIN STEM REDUCTIONS ($000)

Omaha District Projects	Reach Location	Cumulative Thru FY 91	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	Total FY 1992	Cumulative Thru FY 92	
Herreid	SD	33.0							0.0	33.0	
Hooper	NE	541.0							0.0	541.0	
Hot Springs	SD	0.0							0.0	0.0	
Ida Grove	IA	339.0							0.0	339.0	
Kenslers Bend	SD/NE	33,584.0						914.0	914.0	34,498.0	**
Little Papillion	NE	4,475.7							0.0	4,475.7	
Little Sioux River	IA	155,448.0				1,391.6			1,391.6	156,839.6	
Madison	NE	123.2							0.0	123.2	
Mandan	ND	20,323.0							0.0	20,323.0	
Marmarth	ND	1,449.0							0.0	1,449.0	
Meadow Grove	NE	49.0							0.0	49.0	
Norfolk	NE	6,985.0							0.0	6,985.0	
Omaha	NE	370,276.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	370,276.3	
Pebble Ck. @ Scribner	NE	7,859.1			1,706.7				1,706.7	9,565.8	
Pierce	NE	496.0							0.0	496.0	
Platte R. @ Schuyler	NE	665.0							0.0	665.0	
Red Dale Gulch	SD	250.0							0.0	250.0	
Red Oak	IA	6,979.6							0.0	6,979.6	
Saco	MT	987.8							0.0	987.8	
Schuyler, Lost Ck.	NE	394.0							0.0	394.0	
Scranton	ND	0.0							0.0	0.0	
Sheridan	WY	741.0							0.0	741.0	
Shields R. Clyde Park	MT	156.0							0.0	156.0	
Sioux Falls	SD	16,839.8			46.7				46.7	16,886.5	
Vaughn	MT	485.0							0.0	485.0	
Waterloo	NE	470.0							0.0	470.0	
West Glendive	MT	387.0							0.0	387.0	
West Point	NE	2,719.4							0.0	2,719.4	
Subtotal:		1,162,172.4	0.0	0.0	1,753.4	4,758.3	0.0	914.0	7,425.7	1,169,598.1	
Other Projects											
McCook Lake	SD	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	***
Total Corps Projects:	MRO	2,717,157.6	0.0	0.0	6,299.2	22,316.6	11,132.8	914.0	40,662.6	2,757,820.2	

* Includes Missouri River Levees L-627 and L-624.

** Based on estimates of annual benefits. Project serves other than flood control purposes.

*** $400,000 recreational benefits cumulative at the rate of $11,000 annually.

OCTOBER 1992

TABLE 3 (Cont)

FLOOD DAMAGES PREVENTED FY 1992
BUREAU OF RECLAMATION, OMAHA DISTRICT PROJECTS
LOCAL AND MAIN STEM REDUCTIONS ($000)

River Basin	Omaha District Projects	Reach Location	Cumulative Thru FY 91	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	Total FY 1992	Cumulative Thru FY 92
Big Horn River	Boysen	WY	32,602.5	0.0	0.0	0.0	348.2	0.0	0.0	348.2	32,950.7
	Buffalo Bill	WY	3,204.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,204.5
	Bull Lake	WY	1,993.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,993.9
	Yellowtail	MT	42,715.2	0.0	0.0	0.0	856.2	0.0	0.0	856.2	43,571.4
		Subtotal:	80,516.1	0.0	0.0	0.0	1,204.4	0.0	0.0	1,204.4	81,720.5
Cheyenne River	Angostura	SD	20.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.4
	Keyhole	WY/SD	2,026.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,026.8
	Pactola	SD	1,310.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,310.5
		Subtotal:	3,357.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,357.7
Grand River	Shadehill	SD	7,742.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7,742.3
Heart River	Heart Butte	ND	11,824.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11,824.1
James River	Jamestown	ND	18,244.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18,244.4
Marias River	Tiber	MT	40,230.8	0.0	0.0	0.0	69.4	0.0	0.0	69.4	40,300.2
Milk River	Fresno	MT	5,321.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5,321.3
Missouri River	Canyon Ferry	MT	75,449.1	0.0	0.0	0.0	190.3	0.0	0.0	190.3	75,639.4
North Platte River	Pathfinder	WY	4,792.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4,792.2
	Alcova	WY	209.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	209.7
	Seminoe	WY	10,032.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10,032.6
	Guernsey	WY	439.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	439.0
	Glendo	WY/NE	33,639.9	0.0	0.0	439.5	0.0	0.0	0.0	439.5	34,079.4
		Subtotal:	49,113.4	0.0	0.0	439.5	0.0	0.0	0.0	439.5	49,552.9
Sun River	Gibson	MT	2,912.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,912.0
Threeforks Basin	Clark Canyon	MT	6,982.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6,982.1
	Total Bureau Projects:		301,693.3	0.0	0.0	439.5	1,464.1	0.0	0.0	1,903.6	303,596.9

TABLE 4

RECREATION VISITATION IN HOURS

	FY91	FY92	Percent Change
Bowman Haley	140,508	65,400	-53%
Cottonwood Springs	126,076	188,900	50%
Cold Brook	404,810	474,200	17%
Pipestem	300,780	317,200	5%
Papillion Creek #11	1,889,447	1,662,800	-12%
Papillion Creek #16	576,437	628,300	9%
Papillion Creek #18	Not open for Recreation		
Papillion Creek #20	1,182,110	1,073,100	- 9%
Papillion Creek Total	3,647,994	3,364,200	- 8%
Chatfield	4,207,100	4,267,100	1%
Cherry Creek	6,910,800	6,682,400	- 3%
Bear Creek	407,400	432,900	6%
Salt Creek #2	104,969	81,600	-22%
Salt Creek #4	126,594	106,500	-16%
Salt Creek #8	178,987	106,300	-41%
Salt Creek #9	43,964	50,100	14%
Salt Creek #10	137,533	103,700	-25%
Salt Creek #12	235,019	219,600	- 6%
Salt Creek #13	80,882	75,800	- 6%
Salt Creek #14	2,327,735	2,034,200	-13%
Salt Creek #17	4,499,183	3,880,100	-14%
Salt Creek #18	6,004,931	5,184,400	-14%
Salt Creek Total	13,739,797	11,842,300	-14%
TOTAL	**29,656,865**	**27,886,600**	**- 6%**

TABLE 5

UTILIZATION OF EXCLUSIVE FLOOD STORAGE ZONE
OMAHA DISTRICT TRIBUTARY PROJECT

Percent of Flood Control Storage

Year	of Tributary Projects	Total 25% or More	50% or More	75% or More	100% or More
1967	26	3	2	2	0
1968	27	0	0	0	0
1969	27	1	0	0	0
1970	28	2	2	0	0
1971	28	2	1	0	0
1972	28	1	0	0	0
1973	28	6	2	1	0
1974	31	1	1	0	0
1975	32	6	2	1	1
1976	32	2	1	0	0
1977	32	0	0	0	0
1978	33	5	1	0	0
1979	33	1	0	0	0
1980	33	2	1	0	0
1981	33	2	1	1	0
1982	33	2	1	0	0
1983	34	5	1	1	0
1984	35	7	2	1	1
1985	35	0	0	0	0
1986	35	5	0	0	0
1987	35	3	0	0	0
1988	35	0	0	0	0
1989	35	0	0	0	0
1990	35	0	0	0	0
1991	35	2	1	0	0
1992	35	0	0	0	0
TOTAL		**58**	**19**	**7**	**2**

100% or More Events: 1975 - Canyon Ferry Reservoir/1984 - Clark Canyon Reservoir

In January 1992, the Denver Regional Council of Governments (DRCOG) requested the Corps of Engineers' participation in a demonstration project at Bear Creek Reservoir using hypolimnetic withdrawals throughout the year. The water quality in the reservoir and downstream of the reservoir would be monitored to assess the effectiveness of this management practice on water quality. The Corps of Engineers would make variable releases through the year depending on the inflow. The following table shows the approximate release targets as requested by DRCOG:

STREAMFLOW	RELEASE
> 20 cfs	10 cfs
15 - 20 cfs	7 - 9 cfs
10 - 15 cfs	5 - 6 cfs
< 10 cfs	0 cfs

Release changes were made weekly as needed throughout the year and will continue through December 1992.

(b) Chatfield Reservoir, Colorado. During the reporting period, a total of 6 release orders were made while the pool was in the flood control zone. The releases ranged from 400 cfs to 100 cfs and were required only to release inflows to maintain the target pool elevation of 5432.0. These releases occurred between March 5, 1992 and April 21, 1992. Before and after these dates, releases were made by the State Engineer. Gated releases made by the State Engineer varied from a maximum of 550 cfs on August 6, 1991, to 0 cfs on September 11-15, 26-30, and October 1-31. A total of 19,105 AF was delivered via the canals during the reporting period compared with 14,940 AF during the last reporting period. The pool was in the flood control storage zone only slightly from March 1-10, March 25 - April 1, and April 7-21. The maximum pool elevation during this period was 5432.48 on April 19, 1992. All other release orders during the reporting period were made by the State Engineer or his representative.

(c) Cherry Creek Reservoir, Colorado. On April 1, 1988, the State of Colorado, through the State Engineer, implemented strict administration of water rights within the Cherry Creek Basin. When a senior river call is in effect, Cherry Creek Reservoir is required to pass inflow through the project. Releases from the project were coordinated by the Water Control Section to comply with downstream river calls as determined by the Colorado State Engineers Office. A total of 14 release orders were made during the report period. The releases were made to meet downstream water needs and for a sediment flushing exercise. Releases varied from 50 cfs to 2 for water control and water

rights and up to 240 cfs during the flushing exercise. Gate changes were made between August 1, 1991 and July 31, 1992. The sediment flushing releases were made May 19 & 20, 1992 to remove sediments inside of the intake and conduit. This exercise will be completed annually.

(d) Bowman-Haley, North Dakota. A new record low pool was established. No releases were made from the project.

(e) Pipestem, North Dakota. Pipestem pool was drawn down two feet in May to allow maintenance on the gates. Concurrently with the drawndown, the USBR diverted the water released from Pipestem into their Oaks Test Irrigation Area. This drawndown and diversion were criticized by the U.S. Fish and Wildlife Service (FWS) as possibly harmful to their Sand Lake National Wildlife Refuge. A number of meetings were held in Bismarck, ND between the Corps, USBR, and FWS to discuss the drawdown and to review the operation of Pipestem and Jamestown Reservoirs as it affects FWS's refuges. Water Control Section has initiated an update of the design hydrology of Pipestem and the development of a real-time water control model for Pipestem and Jamestown Reservoirs. It is hoped that through this process, impacts to refuges can be lessened during flood events.

(f) Papillion Creek Basin, Nebraska. Due to drought conditions, no low level releases were accomplished this year. No other gated releases were made during the report period.

(g) Salt Creek Basin, Nebraska. No special operations were requested or necessary at the Salt Creek projects during the report period.

Releases were required from Salt Creek #18 to meet downstream senior water rights on August 4 through September 11, 1991 and July 1 through July 7, 1992.

(2) Bureau of Reclamation Dams. Reservoir operations at the eleven Bureau of Reclamation projects in the Omaha District were carried out in accordance with normal regulation procedures during the period covered by this report.

The only Section 7 project that stored water in the flood control zone was Yellowtail Dam. These were relatively minor encroachments that occurred in September 1991 and July 1992.

b. Proposed Operations.

(1) Corps of Engineers. With the exception of Bear Creek, Cheery Creek, Chatfield and Pipestem, all Corps of Engineers tributary dams have ungated service outlets and no gate operations are normally required except for occasional opening of the low level outlets for various purposes. Releases to meet downstream water rights can be expected at Bowman Haley,

Cold Brook, Chatfield, Cherry Creek, and Salt Creek #18. Evacuation of stored flood water in these projects is scheduled as soon as practicable after each flood event.

(a) **North Dakota.** Flood releases from Pipestem Dam will be coordinated with those from the Bureau's Jamestown Dam. The low level gate at Pipestem will be opened when water is flowing over the drop inlet to assist in the improvement of lake water quality. At Bowman-Haley Reservoir, the water quality improvement program calls for releases from the low-level drawdown tube during periods of pronounced lake stratification that typically occur in late winter and again in late summer around July 15. If the local sponsor concurs and winter downstream conditions permit, water will be evacuated from the lower elevations each year starting in early February.

(b) **South Dakota.** Cold Brook reservoir inflows up to 1.1 cfs will be released to the Larive Lake Resort when requested to meet their water right.

(c) **Colorado.** At Chatfield Reservoir, the pool level is expected to fluctuate between elevations 5423 and 5432 ft. MSL at all times except during prolonged periods of drought or excessive run-off. Each year, from May 1 to August 31, the pool level is not expected to fall below elevation 5426.85 ft MSL (20,000 AF) for recreational purposes. Storage of water above elevation 5426.85 to elevation 5432.0 ft. MSL will depend on the availability of free water and/or excessive run-off and/or the desire of the City of Denver to store water. During the Colorado irrigation season, inflows to Cherry Creek Reservoir will be calculated by the Water Control Section and the State Engineer on a daily basis and releases will be balanced on a weekly basis to comply with State water rights. Releases will be made at Cherry Creek Reservoir in May or June to flush sediment from around the gates in the intake structure. Flushes will not be scheduled during the December through March period. The flushing schedule utilizes approximately 150 to 250 AF of water. At Bear Creek Reservoir, the low level gate will be opened when practical during the June through August period when the lake typically stratifies to assist in the improvement of lake water quality if requested.

(d) **Nebraska.** At Salt Creek Dam #18, releases of inflow up to a total of 11.57 cfs may be made. Releases up to 3 cfs without proving inflow will be made when required to satisfy downstream water rights. Low level releases will be made when practicable from the Papio projects to allow water to be discharged from lower elevations in an attempt to improve lake water quality.

(2) **Bureau of Reclamation.** As in the past, the Bureau will continue to operate their reservoirs to meet flood control commitments and to coordinate operations with other interests to achieve optimum use of water resources. Generally, all reservoirs will be operated as close to the top of their conservations pools as possible. Pertinent special operating plans are described as follows: Boysen, Canyon Ferry, Clark Canyon, Tiber and Yellowtail Reservoirs require evacuation and refill of joint-use storage for flood control based on mountain run-off inflow forecasts.

(a) Canyon Ferry. The Canyon Ferry Reservoir Operating Plan requires that releases are adjusted as soon as the storage has peaked, usually in June or July, so the pool will be drawn to near elevation 3780 ft. MSL by the following March 1. In addition, the Montana Power Company will try to limit releases from Hebgen Reservoir to maintain Canyon Ferry pool below elevation 3794 ft. MSL after December 1. Storage below elevation 3794 ft. MSL prior to winter freeze up is desired to prevent ice jam problems at the upper end of the lake. Beginning near the first of January, releases will be set based on the most probable spring inflow forecast to allow the reservoir to fill to elevation 3797 ft. MSL near the end of June.

(b) Tiber. In accordance with the Water Control Agreement, the joint-use zone at Tiber Reservoir will be vacated to elevation 2976 ft. MSL by March 1. March-June releases are based on forecasted inflows with the objective of filling Lake Elwell to elevation 2993 ft. MSL by the end of June. However, if necessary, March-June releases may be based on filling the reservoir to as high as elevation 3008 ft. MSL by the end of June to provide replacement storage and assist the Corps in the operation of the main stem reservoir system.

(c) Yellowtail. Yellowtail Reservoir will be regulated to be no higher than elevation 3630 ft. MSL by November 30 to reduce chances of headwater ice problems. The drawdown will continue through the winter months so that the pool elevation will be no higher than 3605 ft. MSL before the beginning of spring run-off based on a normal run-off forecast. March through July releases will be based on forecasted inflows with the objective of filling Yellowtail Reservoir to elevation 3640 ft. MSL by the end of July.

(d) Others. Replacement storage up to a combined total of 1,075,500 acre-feet can be made available in Clark Canyon, Tiber, and Canyon Ferry Reservoirs on a forecast basis. Fresno Reservoir in Montana is lowered each year and regulated to provide flood control in accordance with a June 4, 1957 Letter of Understanding. In addition to the reservoirs covered in this report, other Bureau reservoirs, without allocated flood control storage space, will provide flood control in their normal operation of storing seasonal run-off. Some of these projects are Gibson Dam in Montana and Bull Lake, Pathfinder, Seminoe, and Buffalo Bill Dams in Wyoming.

VII. MAJOR REGULATION PROBLEMS. Regulation problems experienced during the period of this report are discussed briefly in the following paragraphs.

a. Water Quality. Water quality problems including algal blooms and low dissolved oxygen exist at certain tributary reservoirs. The principal water quality issues and problems at each of the projects during 1992 are covered in a separate report prepared by the Water Quality Unit.

b. Downstream Channel Capacity. Inadequate or reduced channel capacity is a problem below many of the tributary reservoirs. Encroachment by natural plant growth due to low flows, by flood deposits left in place, and by human construction and agriculture practices are common. In some cases, downstream channel capacity is significantly less than flood control releases. For example, the channel downstream of Cold Brook Dam is undefinable due to residential construction. The channel capacity of the South Platte River below the Tri-Lakes projects hinders or prevents releases in accordance with the three-reservoir (Chatfield, Bear Creek, and Cherry Creek) plan of regulation to evacuate flood storage. Compounding this situation is the fact that the reservoir design routings for Chatfield, Bear Creek and Cherry Creek Reservoirs were made independently of each other and that the individual routings neglected 1) the effect of the releases from the other two dams in the three-reservoir system, 2) the effect of the incremental runoff below the dams, and 3) the actual channel capacity below the three dams.

This year's experience with releasing water at the USBR projects has provided valuable information on the downstream channel capacities at these projects. At Boysen Reservoir, the capacity of the downstream channel is limited to around 11,000 cfs by a bridge crossing at Thermopolis. The design discharge is 15,000 cfs. At Yellowtail, the maximum nondamaging release appears to be around 12,000 cfs. The design discharge is 20,000 cfs. A release of 15,000 cfs at Canyon Ferry was made without causing damage. The design discharge is 15,000 cfs.

c. Releases for Purposes other than Authorized Project Functions. No releases were made for purposes other than authorized project functions.

d. Potential Hazardous Conditions. A potential problem exists if water is released over the project spillways where the land downstream of the project has been developed into urban areas. A hazard-to-life condition exists if a significant flow of water is discharged over the spillways at these projects.

VIII. WATER CONTROL MANUALS. Attempts to obtain funding for revision and/or preparation of Water Control Manuals through the O&M budgeting process have continued to be unsuccessful. The District is allocating limited funds from other functions to work on high priority manuals. Final approval on the completed Papillion Creek Water Control Manual is still forthcoming from the Missouri River Division. The Lake Audubon and Westerly Creek Manuals are expected to be completed in Fiscal Year 1993.

Attempts to obtain funding for the Tri-Lakes (Chatfield, Cherry Creek, and Bear Creek) Master Manual has also been unsuccessful. However, a limited amount of funding will be made available in Fiscal Year 1993 to allow development of a detailed scope and cost estimate for inclusion in future budgeting.

IX. DATA COLLECTION PROGRAM AND PROCEDURES.

a. Collection of Water Control Data. Data from hydrologic gages for water control management is obtained from various sources including contract observers, project offices, National Weather Service, Geological Survey, Bureau of Reclamation and Satellite Data Collection Platforms (DCPs). The National Weather Service provides current weather conditions, 3-day forecasts and precipitation and snowfall reports along with current river levels, river level forecasts, and flood forecasts. Since March 1986, this service, called "Datacol", has been retrieved from a NWS computer in Kansas City.

At the end of FY91, the section purchased an Alden weather system including a new computer monitor and services which will allow capture and storage of numerous radar images automatically. This system replaced the Kavouras system which was purchased in 1983.

This system couples with software developed for the Rock Island District which converts radar images to initial precipitation information which then is used in other hydrologic models for real-time and forecasting applications. Radar images from nineteen (19) sites in eight states surrounding the Missouri River basin are available with this system. In addition, the National Weather Service automatically sends satellite images via a direct telephone line to the system.

Since early 1992, the Omaha District, Water Control Section has been developing an HECDSS database for storing river and reservoir data. Data is input into the database from two sources. SHEFDSS is used to read data from the District's Direct Readout Ground Station. A program developed by district programmers reads data retrieved from NOAA's NESDIS computer at Wallops Island, Virginia. The combined data set is then screened using HEC's recently released DATCHK and DATVUE programs.

b. Automated Remote Sensors. State-of-the-art, remote site, satellite data transmissions are utilized for water control management. Satellite collection equipment being used by the District was purchased from Sutron Corporation. The equipment was and is installed and maintained by Section personnel and/or by contract. Currently, there are 21 data collection platforms (DCPs) in Montana, 4 in Wyoming, 21 in Colorado, 12 in North Dakota, 18 in South Dakota, 41 in Nebraska and 16 in Iowa for a total of 133 sites. In FY 1993, DCPs will be installed at five of the Missouri River mainstem dams to automate collection of weather data.

TABLE 6
WORK PRIORITIES

FINAL RESERVOIR REGULATION MANUALS

PRIORITY	PROJECT	REMARKS
1	Tri-Lakes	Manual to be scoped in FY93 for FY95 budget cycle.
2	Papio	Waiting final comments from MRD.
3	Chatfield	Technical Report scheduled completion in FY93.
4	Westerly Creek	Scheduled completion in FY93.
5	Lake Audubon	Scheduled completion in FY93.
6	Canyon Ferry	Scheduled start in FY93.
7	Glendo	
8	Bear Creek	

UPDATE WATER CONTROL MANUALS

1	Pactola	To reflect raise in dam and widening of spillway
2	Coldbrook	To reflect changed outlet pipe and line from stilling basin to Larvie Lake.
3	Shadehill	To reflect changed outlet works.

INSTRUCTION TO DAM TENDERS

1	Heart Butte	To reflect raise in dam.

VOLUME FORECAST

1	Glendo
2	Tiber
3	Boysen
4	Canyon Ferry

The DCPs in the District transmit real-time river and reservoir levels, precipitation, evaporation, piezometer levels, wind, water and air temperature data. The hourly data collected by these remote sensors is transmitted to two ground receiving sites located in Omaha, Nebraska (Corps of Engineers) and Boise, Idaho (Bureau of Reclamation). This information is currently transmitted via GOES-west and GOES-central satellites located at 135 degrees west longitude and 98-108 degrees west longitude, respectively.

A majority of the stream gaging stations in the district use mercury manometers. Mercury exposure and its ensuing life-threatening side effects have prompted the United States Geological Survey (USGS) and the Corps to find a suitable and safe replacement. The Water Control Section and the Iowa USGS have worked together during the past year setting up two experimental stations to test a multitude of possible mercury manometer replacements. The two stations selected were Missouri River at Nebraska City and Big Papillion Creek at 125th and Fort Street, Omaha. The sites were selected due to the near proximity and also because the gage houses are large enough to hold the additional equipment. During the spring of 1992 a Paroscientific (PS2) pressure sensor made by the Hydrologic Instrumentation Facility (HIF), a Watergage I and a Watergage II both manufactured by Fluid Data Systems and a Waterlog (H-300) pressure transducer from Design Analysis Associates were installed at both sites. The stations are being closely monitored for one full year. The data will be examined and compared with that of the mercury manometer to determine the best replacement.

Vandalism continues to be a problem at the gaging stations. The most frequently experienced destruction or theft occurs to the solar panels and antennas. During a span of two weeks, the solar panel and antenna at Zorinsky Lake, Papio Site 18 were vandalized three times. An eight-foot high chain link fence was constructed around the gage house during the summer.

c. Cooperative Hydrologic Programs. Funding for the Omaha District's stream gaging activities is furnished through two programs. The Cooperative Stream Gaging (FC-33) program provides support to seven Geological Survey Districts. The districts are Colorado, Iowa, Montana, Nebraska, North Dakota, South Dakota and Wyoming. Collection and publication of data such as stage, discharge, sediment, water quality and ground water records are the primary functions of this program. The cooperative program also provides funding for DCP and telemark maintenance. The National Weather Service Reporting Network (FC-50) program provides financial support for the collection of data from 40 gaging stations within six river district offices. Formerly operated by the Corps of Engineers, these stations are required for reservoir regulation. The stations are in addition to the regular National Weather Service reporting stations.

d. Water Quality. The Omaha District Water Quality Unit conducts sampling and analysis of physical, chemical and biological parameters on reservoirs in the Omaha District. Projects are normally sampled six times per year by in-house personnel, area personnel or under contract. Occasional surveys and special investigations on all projects are conducted as necessary to identify or resolve specific water quality problems.

In-house personnel sample the Papillion Creek and Salt Creek reservoirs. Bowman-Haley, Coldbrook Chatfield, Bear Creek, Cherry Creek, Lake Audubon, Lake Pocasse, Lake Yankton Pipestem and the Missouri River main stem reservoirs are sampled by area personnel or under contract. Periodic sampling at Cottonwood Springs reservoir has ceased since this project currently impounds very little water.

Inflows and releases are sampled by area or in-house personnel at all tributary projects. Inflows and releases of main stem projects are sampled by area personnel or under contract by the USGS.

Continual remote monitoring and data storage of dissolved oxygen, temperature, conductivity and pH are conducted downstream of Gavins Point, Garrison and Fort Peck Projects. Continual remote monitoring of dissolved oxygen and temperature and periodic monitoring of conductivity and pH is conducted at Big Bend, Fort Randall and Oahe Projects. The monitoring is conducted by Area personnel.

e. Sediment. All suspended sediment samples collected in the Omaha District are obtained by the Geological Survey under the Cooperative Stream Gaging Agreement. Complete sedimentation surveys of small reservoir projects are made at approximately 10 year intervals. These include aggradation surveys to update water volume storage and sediment accumulation values, monitor headwater disposition and lake shoreline erosion; and degradation surveys to monitor downstream channel changes.

X. FLOODING.

The following are excerpts from the National Weather Service's Monthly Report of River and Flood Conditions.

a. Nebraska.

(1) May. The only significant storm of the month fell on the night of the 15th-16th. Some 2-3 inches falling in the North Fork Elkhorn River in the northeast filled the levels at Pierce to Hadar to bankfull and slightly higher levels. The area between Grand Island and Ravenna had localized lowland flooding as 2 to as much as 6 inches fell from the same storm.

(2) June. The only flood producing storm fell on the night of June 15-16 when 2-4 inches fell in the northeast section. A narrow band of 5-6 inches extended from Howells to Beemer where flood waters caused minor damage to the town of Howells in the main business district. Heavy rains filled the Pebble Creek basin briefly out of banks onto lowlands and some county roads.

(3) July. The statewide average monthly rainfall based on 163 Coop Weather Stations was 6.45 inches or 4.07 inches wetter than the 2.38 inch normal. The record of 6.77 inches was set in July 1958. This July was the wettest month in 10 years when May 1982 averaged 6.48 inches.

Looking at the monthly rainfall by climatic sections, the southeast caught 11 inches, the east central 7 to 8 inches, the northeast, central and south central 5 to 6 inches, and the north central, southwest and panhandle 3 to 4 inches. Departures from normal amounts ranged from plus 8 inches in the southeast to plus 1 inch in the far west.

A large storm fell on the evening through early morning hours of the 24th and 25th in southeast Nebraska. Intense and widespread rains of 4 to 7 inches fell in the evening hours from Nebraska City to Syracuse to Roca to Crete bringing flash flooding to many towns and villages affecting mainly basements, streets and some city parks. The rural areas suffered serious cropland flooding, county road and culvert washouts. These rains fell in the upper reaches of Little Nemaha, Salt, Big Nemaha, and Big Blue river basins.

The very next afternoon, additional 1 to 3 inches fell in the far southeast bringing the Little Nemaha River at Auburn to its highest levels in 13 years. The local state highway flooded, as well as considerable croplands along the bottomlands. Falls City came 5 to 6 feet out of banks flooding its lowlands to its mouth and briefly closing a state highway.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Missouri River at Rulo, NE	17	7/29	7/30	20.5	7/30
Salt Creek at Roca, NE	19	7/25	7/25	21.76	7/25 (11,000 cfs)
Little Nemaha River at	22	7/25	7/26	24.6	7/25 (42,000 cfs)
Auburn, NE		7/30	7/30	22.8	7/30

b. Iowa.

(1) **March.** The first major precipitation event occurred March 5th-6th, with .50 to 1.50 inches falling over much of the state. The runoff from this rain event, combined with the previous increased flows, pushed several rivers, mainly in northern Iowa, out of their banks. Only minor flooding occurred, however, and by the middle of the month most rivers were back within bank.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Little Sioux River at Spencer, IA	10	3/7 3/9	3/7 3/11	10.1 10.3	3/7 3/10
at Linn Grove, IA	12	3/9	3/14	12/72	3/11

(2) **April.** The first significant precipitation of the month fell on April 15-16, when portions of the northwest and the southeast half of the state received more than half an inch. Local 1 to 1.5 inch amounts were observed, and Mount Ayer in extreme southern Iowa measured 2.42 inches. This helped saturate the soil for the next major rain event.

On the 18th and 19th, widespread rains of .75 to 1.75 inches fell over the state, pushing most rivers and streams to near bankfull, and causing minor flooding in a few locations. Another .50 inch to an inch fell over many sections during the next 48 hours, resulting in minor flooding scattered over many sections of the state. The weather turned drier during the last week of April, and most rivers had either fallen below flood stage or were falling.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Little Sioux River at Spencer, IA	10	4/20	4/26	11.9	4/22
at Linn Grove, IA	12	4/21	4/29	15.54	4/23
at Cherokee, IA	17	4/24	4/24	17/6	4/25

(3) May. Between 1 and 2 inches was reported over the Little Sioux and Boyer River basins May 16-17. This resulted in brief crests slightly above flood stage on portions of the Little Sioux River.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Little Sioux River at Spencer, IA	10	5/18	5/18	10.2	5/18

(4) July. July was a cool month, averaging 5.5 degrees below normal at 68.8 degrees. This was second coolest July in 120 years.

On the 10th, 2-3 inches fell over the headwaters of the Floyd River. Widespread 1 to 2 inch amounts were received over central and eastern portions on the 24th and 25th.

Due to the dry antecedent conditions, only minor river flooding was observed at scattered locations around the state.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Little Sioux River at Spencer, IA	10	7/11 7/26	7/20 7/29	11.3 10.8	7/14 7/27
at Linn Grove, IA	12	7/15	7/18	12.09	7/15
at Cherokee, IA	17	7/13	7/13	17.4	7/13
Nishnabotna River at Hamburg, IA	16	7/13	7/13	18.94	7/13

c. <u>South Dakota</u>.

(1) March. Flooding on the Big Sioux River occurred the first several days of March. Most of the damage caused by flooding was to agriculture. Since the flooding occurred well before planting, the damage was slight.

(2) **June.** A localized flash flood occurred in the northwest corner the 13th. Six to possibly 10 inches of rain fell near Ludlow, causing Crooked Creek to washout culverts and fences. For a more detailed description of this event, see the project write-up for Bowman-Haley Reservoir.

A few spots in the northeast and east central also experienced flooding. A precipitation observer at Clear Lake recorded 2.60 inches the 15th, 4.55 inches the 16th and 4.38 inches the 17th. Hidewood Creek had extensive flooding due to this rain. This flooding covered most of the rural road crossing over the Big Sioux River in the areas of Dempster, Estelline and Bruce. As the crest of the Big Sioux moved downstream, it was mostly in-bank by the time it reached Sioux Falls.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Big Sioux River at Brookings, SD	9	6/20	6/27	12.4	6/20
at Dell Rapids, SD	12	6/24	6/25	12.3	6/24

(3) **July.** On the evening of July 1st, heavy rains fell in the southeast Sioux Falls to Brandon to Garretson area with several 5-inch plus reports. The lower portion of the Split Rock Creek flooded and the Big Sioux River, which was still high the mid June runoff event, flooded from Split Rock Creek downstream to Akron.

FLOOD ABOVE FLOOD STAGE PEAK

River & Station	Stage	From	To	Stage	Date
Big Sioux River at Hawarden, IA	15	7/4	7/5	17.4	7/4
at Akron, IA	16	7/5	7/6	18.0	7/6

d. North Dakota. No flooding in the Omaha District boundaries was observed during the reporting year.

e. **Montana.**

June. Moderate to heavy precipitation fell along most of the Yellowstone River basin the third and fourth week of June. With the soil being dry and most of the major rivers well below normal, heavy rains came out of the Crazy Mountains and destroyed a levee on the Shields River in Park County on June 17th. The resulting flood washed out two county roads, dirt around several bridge abutments, a culvert and flooded several acres of pasture land.

f. **Wyoming.** No flooding in the Omaha District boundaries was observed during the reporting year.

g. **Colorado.**

(1) August. Urban and Small Stream Flood Advisories were required for Denver and the surrounding area on August 2nd, when a major rain event produced between one and two inches of rain in an hour period. Many cars were stranded by high waters in streets and underpasses and small hail compounded the problem by clogging drains. No serious stream and river flooding was reported.

The heavy rain potential increased on August 3rd and Flash Flood watches were issued for much of the eastern foothills area. Locally heavy rains were reported over much of the watch area. Street and highway flooding was fairly widespread, but no river or stream flooding was reported.

Another event on August 4th produced street flooding in a small area of southeast Denver and prompted the issuance of an Urban and Small Stream Flood Advisory for that area. The next major event was on the sixth when Urban and Small Stream Flood Advisories were posted for parts of Park County where a small stream flood closed a highway for a short time. On the same day, minor street flooding was reported in Denver, Jefferson, Weld and Boulder Counties.

The last significant heavy rain event was on August 19th, when a flash flood warning was required for Clear Creek County to the west of Denver. Heavy rain caused Clear Creek and several small tributaries to come out of their banks. Numerous mudslides were recorded in the vicinity.

(2) May. On May 26th a flash flood watch was issued for the northwest plateau and the northern mountains of Colorado due to locally heavy rains. Nearly one and a half inches of rain fell in two to three hours in some locations. Water over roads was reported, but no significant damage occurred.

On May 27th, a Small Stream Flood Advisory was issued for Plateau Creek at Cameo, northeast of Grand Junction, where the stream rose slightly above flood stage for

a few hours. Again, water came over the road in one or two places but no damage was reported.

(3) June. The first significant precipitation event of the month was on June 8th. A cold front meeting moist unstable air produced widespread rain and hail along the front range. An Urban and Small Stream Advisory was followed by a flash flood warning for portions of the Denver Metropolitan Area. Boulder Creek and St. Vrain Creek were reported out of their banks near I-25. Rains of two to three inches in a one hour period in the warning area forced the closure of I-25 for two hours in both directions.

Another rain event on June 20th prompted the issuance of an Urban and Small Stream Advisory for southern Boulder and central Jefferson Counties. No serious flooding occurred.

A Small Stream Advisory was required for portions of Douglas County on June 23rd as Doppler Radar indicated two inches or more of rain in a two hour period near the headwaters of Plum Creek. No serious flooding was reported.

Rains of over two inches in a short period of time prompted the issuance of an Urban and Small Stream Flood Advisory on the 24th for portions of Larimer County. Three feet of water was reported at some street intersections in Fort Collins although no gaged streams were reported out of their banks.

(4) July. An Urban and Small Stream Flood Advisory was issued for the eastern Denver Metro Area on July 15th when as much as three inches of rain fell in a short time in the advisory area. Many roads were flooded. There were numerous reports of clogged drains and flooding of low lying areas as well as overbank flows on some small streams in the advisory area. No serious flooding was reported.

Another Urban and Small Stream Flood Advisory was issued for the southern portion of the Denver Metro Area on July 20th. Heavy thunderstorms caused considerable street flooding and drainage problems but no serious damage.

Small Stream Flood Advisories were required for eastern Arapahoe and southern Washington Counties on July 23rd. Up to four inches of rain in two to three hours caused minor flooding of small streams as well as numerous reports of water over roads and other flooding of low lying areas.

XI. WATER CONTROL INITIATIVES. During the report period, studies by the Water Control Section and others included the following:

Missouri River Division Water Control Data System Master Plan. The Omaha District has acquired a Unix based workstation within the Water Control Section. The workstation will be used for daily data acquisition and operational functions within the section. The Hydrology Branch network has converted to an ethernet networking system

which has been connected to the district's ethernet backbone. This will allow the section to communicate through the backbone system with the Reservoir Control Center and many other offices both within and outside the Corps.

Several years ago, Waterways Experiment Station (WES) developed software for the Rock Island District and others to be used in conjunction with the Alden weather radar system. The software reads the Alden radar files and computes rainfall amounts over an area. This information can then be read into other software such as runoff models. This year, as part of the Oahe Dam Safety exercise, Water Control and WES modified the software by inputting Bad River basin (South Dakota) information. The hourly precipitation values generated by the software were written to DSS and then input into a HEC-1F inflow forecasting model that was developed for the Bad River basin. Hydrograph(s) from the HEC-1F model were then input into hydraulic models such as HEC-2 and UNET.

Water Control Section is in the process of installing a 2.4 meter antenna on the roof of the Zorinski Federal Building. This dish will be used as part of a Domsat Receive Only Terminal (DROT) for GOES Data Collection System (DCS). Messages will be received and processed by two "data capture" terminals, loaded with SCO Unix operating system and DCS Automated Processing System software. Programs have been written that will transfer this data into the DSS database residing on the CDC 4330 workstation. The section has also developed download routines which write downloaded Vax data to HEC-DSS database format. This database will then be used in conjunction with the Unix based programs developed at HEC on the workstation.

XII. FERC Applications. During the period of this report, 9 applications for preliminary permits, licenses or exemption from licensing were made to the Federal Energy Regulatory commission by various entities for studies in connection with new or existing hydropower facilities within the Omaha District. These applications were reviewed and comments were prepared by the Omaha District on the impacts of the proposed plant.

XIII. TRAINING AND METHODS. During the period of this report, employees in the Section attended the courses listed below:

1. Hydrologic Data Management	Davis, CA	40 hours May 92
2. UNIX Usage & Shell Prog	Omaha, NE	40 hours Feb 92
3. CPR/First Aid Training	Omaha, NE	8 hours Apr 92
4. Real Time Water Control	Davis, CA	80 hours Dec 91
5. Mo Riv Nav Exc	Omaha, NE	8 hours Jun 92
6. Long Term Training	Omaha, NE	2080 hours 91-92

On-the-Job instruction and training of new employees and existing staff members continues as duties and new techniques require.

XIV. PERSONNEL. The personnel strength of the Water Control Section currently consists of three Hydraulic Engineers, four Hydraulic Engineering Technicians, one Secretary, and one Hydraulic Engineering Technician (part-time college student); a total of 9 personnel.

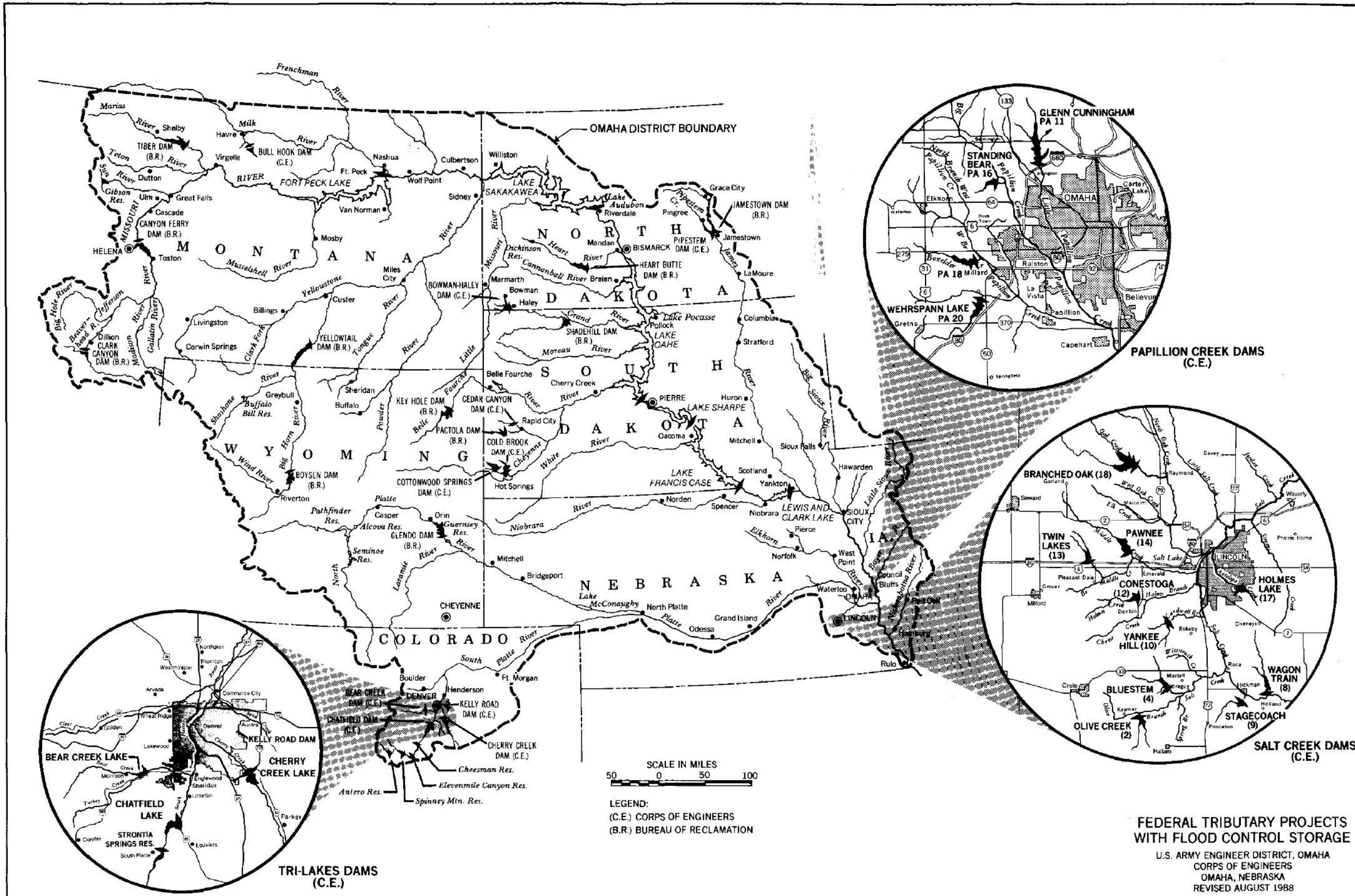
MAP

OF

FLOOD CONTROL

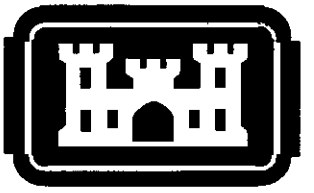
DAMS

APPENDIX 1



FEDERAL TRIBUTARY PROJECTS
WITH FLOOD CONTROL STORAGE

U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
REVISED AUGUST 1988



PROJECT DATA SHEETS - TRIBUTARY

(5 SHEETS)

CORPS OF ENGINEERS DAMS

SALT CREEK BASIN DAMS - C.E.

PAPILLION CREEK BASIN DAMS - C.E.

BUREAU OF RECLAMATION DAMS

SUBIMPOUNDMENT DAMS (TWO) - C.E.

SUMMARY OF ENGINEERING DATA — FEDERAL RESERVOIRS WITH AUTHORIZED FLOOD CONTROL
MISSOURI RIVER TRIBUTARIES — U.S. ENGINEER DISTRICT — OMAHA
CORPS OF ENGINEER DAMS

ITEM NO	SUBJECT	BEAR CREEK	BOWMAN HALEY	BULL HOOK — SCOTT COULEE	CEDAR CANYON	CHATFIELD	CHERRY CREEK	COLD BROOK	COTTONWOOD SPRINGS	KELLY ROAD	PIPESTEM
	GENERAL										
1	Location of dam	3 mi. S.W. of Denver, Colo.	8 mi. W. of Haley, N.D.	1 mi. S. of Havre, Mont.	3.5 mi. W. of Rapid City, S.D.	8 mi. S. of Denver, Colo.	10 mi. S.E. of Denver, Colo.	1 mi. N. of Hot Springs, S.D.	4.5 mi. W. of Hot Springs, S.D.	Lowry A.F.B., Denver, Colo.	3 mi. N.W. Jamestown, N.D.
2	River and river mile	Bear Creek R.M. 4	N. Fk. Grand R.M. 160	Bull Head Cr. - Scott Coulee	Deadman's Gulch	South Platte River R.M. 321	Cherry Creek R.M. 11.4	Cold Brook R.M. 1	Cottonwood Springs Creek	Westerly Creek	Pipestem Creek R.M. 3
3	Drainage area (sq. mi.)	236	448	54	0.4	3,618	386	70.5	79	19.84	554
4	Reservoir length (mi.)	0.5 at el. 5556	2.5 mi. at el. 2755	Normally dry	Normally dry	3.0 at el. 5430	1.5 at el. 5556	1.2 at el. 3846.5	0.8 mi. at el. 3875	Normally dry	5.5 at el. 1442.4
5	Location of Dam/order	At Chatfield Dam	Garrison Dam	Ft. Peck Dam	Dahl Dam	On site	At Chatfield Dam	On site	At Cold Brook Dam	Rocky Mt. Area	On site
6	Travel time to Missouri River	2 weeks	1 day to Shadehill Dam	---	---	2 weeks	---	---	---	---	3 weeks
7	Max. discharge of record	8,600 cfs July 1965	14,100 cfs April 1952	---	440 cfs August 1945	110,000 cfs June 1965	58,000 cfs Sept. 1938	8400 cfs	---	---	6,080 cfs April 1969
8	Project cost (1)	$61,700,000	$4,372,200	$1,837,300	$122,500	$141,136,000	$14,875,000	$9,571,000	$2,885,000	$232,000 (Original Cost)	$9,277,500
	DAM AND EMBANKMENT										
9	Top of dam — ft. MSL	5689.5	2794.0	2613.3 (U.B.H.) 2613.3 (S.C.)	3554.0	5547	5844.5	3875.0	3955.0	5372.0 5363.0 Weir Elev.	1507.5
10	Length of dam — ft.	5,300 — main 2,100 — South	5730	1909 (B.H.) 1500 (S.C.)	1320	13,136	14300	925	1196	4700	4000
11	Height of dam — ft.	179.5 — main 85 — South	70	73 (B.H.) 53 (S.C.)	47	147	143	127	123	32	107.5
12	Stream bed — ft. MSL	5,510	2715	2540 (B.H.) 2560 (S.C.)	3512	5360	5504	3548	3832	5340	1400
13	Abutment formation	Clay, shale, siltstone, sandstone	Ludlow, sandy clay, silty sand	Glacial till, lean clay	Minnekahta limestone	Sandstone, clay, silt	Sandstone, shale, limestone	Sandstone, shale, limestone	Minnekahta limestone	Overburden — sandy clay	Sandy overburden — P. Shale
14	Type of fill	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth
15	Fill quantity in cu. yds.	11,348,000—main 770,000—South	1,750,000	1,300,000	150,000	14,850,000	13,000,000	1,072,000	950,000	700,000	1,990,000
16	Date of closure	Jul. 1977	Aug. 1986	Oct. 1955	Sep. 1959	Aug. 1973	Oct. 1948	Sept. 1952	May 1969	Nov. 1953 Rehab. 1978	Jul. 1973
17	Date of initial fill (base F.C.)	May 1979	Mar. 1989	---		Jun. 1979	March 1950	Jun. 1953 (3584.7)	---	---	May 1974
	SPILLWAY			*Notch in SH to 2540							
18	Discharge capacity — cfs	153,500 cfs at el. 5664.5	82,870 cfs at el. 2780	25,200 cfs at el. 2605	1400 cfs at el. 3550.6	186,000 cfs at el. 5521.8	36,350 cfs at el. 5838.2	60,000 cfs at el. 3867.2	39,600 cfs at el. 3950.3	3500 cfs at el. 5368.8	16,200 cfs at el. 1502.8
19	Crest elev. — ft. MSL	5667.0	2777	2583.0 (B.H.)* 2586.0 (S.C.)	3545.9	5500.0	5838.2	3846.5	3936.0	5362.0	1498.5
20	Width — ft.	800	650	---	80	500	67	200	275	120	1500
21	Gates, number, size, type	Ungated earth channel	Ungated earth notch (2)	Ungated earth channels	Ungated rock channel	Ungated converging chute	Ungated earth channel	Ungated sharp crested weir	Ungated broad weir	Uncontrolled Concrete U wall and chute	Ungated earth channel
	RESERVOIR ELEV. AND AREA										
22	Maximum pool	5684.5 1237a	2788.0 7918a	2605.0 (B.H. & S.C.) 384a	3550.6 15a	5571.8 5672a	5838.2(3) 454aa	3867.2 278a	3952.0 257a	5368.8 43a	1502.8 7105a
23	Top of flood control pool	5635.5 715a	2777.0 5134a	2583.0 (B.H. & S.C.) 283a	3545.9 11a	5560.0 4764a	5828.7 3491a	3851.4 196a	3936.0 214a	5362.0 34a	1496.3 4754a
24	Top of multipurpose pool	5558.0 107a	2754.8 1722a	none	none	5432.0 1422a	5550.0 844a	3845.0 36a	3875.0 41a	none	1442.4 985a
25	Top of inactive pool	5528.0 17a	2740.0 565a	none	3528.0 0a	none	none	none	3868.0 30a	none	1415.8 62a
	STORAGE ZONES (Elev.-Capacity)			Total — (B.H. & S.C.)							
26	Surcharge	5636.5-5684.5 47,350AF	2777.0-2788.0 77,085AF	2583.0-2605.0 6060AF	3545.9-3550.6 74AF	5560-5521.8 116,215AF	5569.0-5838.2(3) 134,436AF	3851.4-3867.2 3,500AF	3936.0-3952.0 3,250AF	5362.0-5368.8 200AF	1496.3-1502.8 36,850AF
27	Flood control	5558.0-5635.5 28,757AF	2754.8-2777.0 72,717AF	2540.0-2583.0 650AF	3528.0-3545.9 123AF	5432.5500.0 208,945AF	5550.0-5828.7 122,642AF	3845.0-3851.4 8,580AF	3875.0-3936.0 7,730AF	5342.0-5362.0 360AF	1442.4-1496.3 137,010AF
28	Multipurpose	5528.0-5558.0 1,857AF	2740.0-2754.8 15,456AF	none	none	5385-5432 76,134AF	5504.0-5550.0 52,0AF	3548.0-3585.0 520AF	3868.0-3875.0 245AF	none	1415.8-1442.4 9,580AF
29	Inactive	5510-5528.0 70AF	2715.0-2740.0 3,309AF	none	3512.0-3528.0 13AF	5377-5385 29AF	none	none	3832.0-3868.0 406AF	none	1400.0-1415.8 280AF
30	Gross (top of flood control pool)	50,684AF	91,487AF	650AF	136AF	235,008AF	92,126AF	7,290AF	8,385AF	360AF	146,890AF
	OUTLET WORKS										
31	Number and size — conduits	1 — 7 ft. circular — upstream 1 — 7x10.5 ft. — downstream	1 — 10 ft. circular conduit	1 — 30 in. RCP w/ Bull Hook 1 — 30 in. RCP — Scott Coulee	1 — 24 in. C.M.P.	2—11x16 ft. oval conduit	2 — 8x12 ft. oval conduit 1 — 12 ft. circular conduit	1 — 6.67 ft. conduit 1 — 8 in. supply line	1 — 48 in. concrete	1 — 5.5 ft. circular conduit 1 — 30 in CMP	1 — 8 ft. circular conduit
32	Conduit length — ft.	1880 ft. Ungated drop inlet — el. 5558	341 ft. Ungated Glory Hole — el. 2754.8	293 ft — Bull Hook 298 ft — Scott Coulee	230 ft	1289 ft	679.5 ft.	907 ft. Ungated drop inlet — el. 3545	580 ft. Ungated drop inlet — el. 3875		675 ft. Ungated drop inlet — el. 1442.4
33	Number — size — type gates	2 — 2x6 ft. hydraulic slide 2 — 1x1 ft. slide — gate on gate	2 — 30 in. valves — el. 2740.0 1 — 30 in. interior gate valve 1 — 30 in. interior slide gate	1 — 24 in. valve, Bull Hook 1 — 24 in. valve, Scott Coulee	Ungated inlet — el. 3526	2 — 8x13.5 ft. hydraulic slide 2 — 2x2 ft. slide — gate on gate 1 — 72 in. butterfly	5 — 8x8 ft. — hydraulic slide 2 — 16 in. bypass gates	3 — 12 in. gate valves — el. 3548 1 — 8 in. valve 250 cfs at el. 3600.0	1 — 3x3 ft. gate — el. 3868	Gated inlet — el. 5347.0	2 — 4x7 ft. hydraulic slide 1 — 36 in. valve, 1.3x3 ft. slide
34	Discharge capacity	2,100 cfs at el. 5667	Glory Hole — 3286 cfs at el. 2799 30 in. valve — 140 cfs at el. 2755	123 cfs at 2583 — Bull Hook 103 cfs at 2593 — Scott Coulee	49 cfs at el. 3545	8400 cfs at el. 5500.0	8100 cfs at el. 5998.0	1540 cfs at el. 3851.4	580 cfs at el. 3936.0	578 cfs at el. 5362.0	2,300 cfs at el. 1496.3
35	**POWER INSTALLATION**	none	none	none	none	none	none	none	none	none	none

(1) Costs are as of 9-30-89

(2) Bowman Haley Spillway equipped with Fuse Plug (Crest Elevation 2780.7 ft MSL)

(3) Due to updated Hydrological Improvement Agreement for Cherry Creek Reservoir, with the maximum pool the dam would be overtopped

SUMMARY OF ENGINEERING DATA — FEDERAL RESERVOIRS WITH AUTHORIZED FLOOD CONTROL
MISSOURI RIVER TRIBUTARIES — U.S. ENGINEER DISTRICT — OMAHA
SALT CREEK BASIN — NEBRASKA

ITEM NO.	SUBJECT	DAM NO. 2 (Olive Creek Lake)	DAM NO. 4 (Blue Stem Lake)	DAM NO. 8 (Wagon Train Lake)	DAM NO. 9 (Stagecoach Lake)	DAM NO. 10 (Yankee Hill Lake)	DAM NO. 12 (Conestoga Lake)	DAM NO. 13 (Twin Lakes)	DAM NO. 14 (Pawnee Lake)	DAM NO. 17 (Holmes Park Lake)	DAM NO. 18 (Branched Oak Lake)
	GENERAL										
1	Location of dam	1.5 mi. E. of Kramer	2.5 mi. W. of Sprague	1.5 mi. N. of Holland	1 mi. S. of Hickman	3.5 mi. E. of Denton	1.5 mi. W. of Denton	2 mi. N.W. of Pleasantdale	2 mi. N.W. of Emerald	S.E. edge of Lincoln	4 mi. W. of Raymond
2	River and mileage	S. Trib. of Olive Br.	N. Trib. of Olive Br.	N. Trib. of Hickman Br.	S. Trib. of Hickman Br.	Cardwell Br.	Holmes Cr.	Middle Cr.	W. Middle Cr.	Antelope Cr.	Oak Cr.
3	Drainage area in square miles	6.2	16.8	15.6	9.7	6.4	15.1	11.0	35.9	5.4	68.7
4	Reservoir length in miles	1.2	1.8	1.8	1.4	0.7	1.4	1.5	3.0	0.7	3.7
5	Location of Spillway	none	none	none	none	none	none	none	none	none	none
6	Travel time to Lincoln, NE	23 hrs.	13 hrs.	14 hrs.	6 hrs.	9 hrs.	9 hrs.	13 hrs.	7 hrs.	3 hrs.	6 hrs.
7	Max. discharge of record	--	--	--	--	--	--	--	--	--	--
8	Project cost	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
	DAM AND EMBANKMENT										
9	Top of dam — ft. MSL	1359.0	1334.0	1312.0	1294.0	1278.0	1280.0	1354.0	1271.0	1273.0	1320.0
10	Length of dam — ft.	3020.0	2790.0	1650.0	2250.0	3160.0	3600.0	2075.0	5000.0	7700.0	5260.0
11	Height of dam — ft.	45.0	57.0	52.0	48.0	52.0	63.0	58.0	65.0	55.0	70.0
12	Stream bed — ft. MSL	1314.0	1277.0	1260.0	1246.0	1218.0	1197.0	1306.0	1206.0	1218.0	1250.0
13	Abutment formation	Clay — sand — silt	Clay — sand	Clay	Clay — sand	Clay — sand	Clay — sand	Clay — sand — silt	Clay — sand	Clay — sand	Clay — sand — silt
14	Type of fill	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth
15	Fill quantity in cu. yds.	312,000	471,000	378000	374000	502000	658000	612000	876000	900000	2460000
16	Date of closure	20 Sep. 1963	12 Sep. 1962	24 Sep. 1962	27 Aug. 1963	5 Oct. 1965	24 Sep 1963	26 Sep. 1965	16 Jul. 1964	12 Sep. 1962	21 Aug. 1967
17	Date of initial fill	30 Jun. 1965	8 Jul 1963	24 Jun. 1963	25 May 1965	10 Jun. 1967	May 1965	16 Mar. 1966	21 Jun. 1967	2 Jun. 1965	18 Jun. 1973
	SPILLWAY										
18	Discharge capacity — cfs	15875 at el. 1357.1	22925 at el. 1331.7	23210 at el. 1309.8	17585 at el. 1291.6	12100 at el. 1267.8	27220 at el. 1258.2	25200 at el. 1361.5	19675 at el. 1269.1	800 at el. 1299.7	7825 at el. 1312.5
19	Crest elev. — ft. MSL	1350.0	1322.5	1302.0	1285.0	1262.0	1252.0	1353.0	1263.5	1266.0	1311.0
20	Width — ft.	340.0	340.0	430.0	430.0	400.0	750.0	400.0	760.0	50.0	200.0
21	Gates: number, size, type	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel
	RESERVOIR ELEV. AND AREA										
22	Maximum pool	1357.1 478A.	1331.7 986A.	1309.8 875A.	1291.6 648A.	1267.8 624A.	1258.2 733A.	1361.6 645A.	1269.1 1672A.	1299.7 457A.	1317.3 4267A.
23	Top of flood control pool	1350.0 355A.	1322.5 645A.	1302.0 640A.	1285.0 490A.	1262.0 484A.	1252.0 626A.	1355.0 505A.	1263.5 1408A.	1266.0 391A.	1311.0 3640A.
24	Top of joint use pool	none	none	none	none	none	none	none	none	none	none
25	Top of conservation pool	1335.0 174A.	1307.4 309A.	1287.8 303A.	1271.1 198A.	1244.9 294A.	1232.9 230A.	1341.0 255A.	1244.3 737A.	1242.4 125A.	1284.6 1780A.
26	Top of sediment pool	1335.0 174A.	1306.1 284A.	1284.6 225A.	1271.1 198A.	1241.9 176A.	1232.9 230A.	1337.4 205A.	1244.3 737A.	1240.0 102A.	1275.7 1270A.
	STORAGE ZONES (Elev.-Capacity)										
27	Surcharge zone	1350.0-1357.1 2910AF	1322.5-1331.7 7215AF	1302.0-1309.8 5990AF	1285.0-1291.6 3725AF	1262.0-1267.8 4245AF	1252.0-1258.2 4245AF	1355.0-1361.6 3799AF	1263.5-1269.1 8583AF	1266.0-1299.7 1536AF	1311.0-1317.3 24720AF
28	Exclusive flood control zone	1335.0-1350.0 3980AF	1307.4-1322.5 7113AF	1287.8-1302.0 5790AF	1271.1-1285.0 4700AF	1244.9-1262.0 5854AF	1232.9-1252.0 8639AF	1341.0-1355.0 5758AF	1244.3-1263.5 20990AF	1242.4-1266.0 5885AF	1284.6-1311.0 21570AF
29	Joint use zone	none	none	none	none	none	none	none	none	none	none
30	Conservation zone	none	1306.1-1307.4 386AF	1284.6-1287.8 830AF	none	1241.9-1244.9 983AF	none	1337.4-1341.0 818AF	none	1240.0-1242.4 273AF	1275.7-1284.6 17740AF
31	Sediment pool zone	1314.8-1335.0 1490AF	1277.0-1306.1 2295AF	1260.6-1284.6 1960AF	1246.0-1271.1 1940AF	1218.0-1241.9 1115AF	1197.6-1232.9 2610AF	1306.0-1337.4 2020AF	1206.0-1244.3 7826AF	1218.0-1240.0 632AF	1250.0-1275.7 13250AF
32	Gross Storage (Excl. of surcharge)	5470 AF	9794AF	9260AF	8640AF	7963AF	10849AF	8086 AF	28118AF	8790AF	97560AF
	OUTLET WORKS										
33	Number and size — conduits	1—CMP—48" Dia. With 30" RCP lining	1—CMP—60" Dia With 42" RCP lining	1—CMP—60" Dia With 42" RCP lining	1—CMP—48" Dia. With 30" RCP lining	1—CMP—48" Dia With 30" RCP Lining	1—CMP—60" Dia With 42" RCP lining	1—CMP—42" Dia. With 30" RCP lining	1 — CMP — 60" Dia. With 42" RCP lining	1 — CMP — 60" Dia With 42" RCP lining	1—CMP—concrete Lined—72" Dia
34	Conduit length — ft.	290	315	290	260	308	318	335	382	320	370
35	Gated outlets (No. — size — type — invert elev.)	1—36"x36" Lift gate—1330.0	1—36"x36" Lift gate—1303.0	1—36"x36" Lift gate—1285.5	1—36 x36" Lift gate—1261.9	1—36"x36" Lift gate—1228.0	1—36"x36" Lift gate—1228.0	1—42"x54" Lift gate—1333.0	1—42"x50" Lift gate—1736.0	1—36"x36" Lift gate—1239.0	1—48"x72" Lift gate—1274.0
36	Ungated outlets (Openings — size — elev.)	2—24"x72"—1340.9 2—12"x30"—1335.0	2—30"x96"—1313.5 2—12"x54"—1307.4	2—36"x96"—1292.6 2—12"x34"—1287.8	2—24"x72"—1277.1 2—12"x30"—1274.1	2—18"x53"—1259.0 2—12"x39"—1244.9	2—30"x96"—1242.3 2—12"x34"—1232.9	2—30"x96"—1241.0 2—24"x63"—1341.0	2—34"x120"—1244.3	2—30"x96"—1240.0 2—12"x36"—1242.5	1—10' Dia. wide gate—1276.3 2—42"x144"—1263.95
37	Stoch. capac. — cfs (At base of EFC zone)	90	75	75	80	95	60	145	210	60	300
	POWER INSTALLATION										
38	No. and size of turbines	none	none	none	none	none	none	none	none	none	none
39	No. and rating of generators										
40	Plant capacity										
41	Power Plant disch. capac. (At base of EFC zone)										

(1) Total project financial cost including all dams = $12,875,000 (Costs are as of 9-30-80)

October 1980

SUMMARY OF ENGINEERING DATA — FEDERAL RESERVOIRS WITH AUTHORIZED FLOOD CONTROL
MISSOURI RIVER TRIBUTARIES — U.S. ENGINEER DISTRICT — OMAHA
PAPILLION CREEK BASIN — NEBRASKA

ITEM NO.	SUBJECT	DAM NO. 11 (Gilpen Cunningham Lake)	DAM NO. 16 (Standing Bear Lake)	DAM NO. 18 (Zorinsky Lake)	DAM NO. 20 (Wehrspann Lake)						
	GENERAL										
1	Location of dam	83rd State Street	132nd and Fort Street	150th and "F" Street	156th and Giles Road						
2	River and mileage	Knight Creek —	Tributary Big Papio —	Gamston Creek —	Trib. South Branch Papio —						
3	Drainage area (sq. mi.)	17.8	6	16.4	13.1						
4	Reservoir length in miles	2.5	1.0	1.5	1.5						
5	Location of Dambender	None	None	None	None						
6	Travel time to Missouri River	5-10 Hours	5-10 Hours	5-10 Hours	5-10 Hours						
7	Max. discharge of record	—	—	—	—						
8	Project cost (1)	$11,800,000	$4,309,000	$20,656,000	$14,854,805						
	DAM AND EMBANKMENT										
9	Top of dam — ft. MSL	1152	1139.0	1143.5	1131						
10	Length of dam — ft	1940	1480	1400	1618						
11	Height of dam — ft.	57	70	64	56						
12	Stream bed — ft. MSL	1085	1050	1079.5	1069						
13	Abutment formation	Lean clay loess	Lean clay loess	Lean clay loess	Lean clay loess						
14	Type of fill	Rolled earth	Rolled earth	Rolled earth	Rolled earth						
15	Fill quantity in cu. yds.	858,000	481,000	1,263,000	767,450						
16	Date of closure	5 Aug 1974	3 Oct 1977	15 July 1984	21 Sep 1982						
17	Date of initial fill	2 Sep 1977	24 Oct. 1977	—	26 May 1967						
	SPILLWAY										
	Discharge capacity — cfs (max. pool)	18,700	9,500	30,000	12,000						
	Crest elev. — ft. MSL	1142	1121	1128.2	1120						
	Width — ft.	700	250	400	600						
	Gates, number, size, type	Ungated earth channel	Ungated earth channel	Ungated earth channel	Ungated earth channel						
	RESERVOIR ELEV. AND AREA										
22	Maximum pool	1147 1170a	1127 366a	1138.2 805a	1125.6 606a						
23	Top of flood control pool	1142 894a	1121 300a	1128.2 594a	1113.1 488a						
24	Top of multipurpose pool	1131 377a	1104 137a	1110.0 253a	1095.83 238a						
					(See (2) footnote)						
	STORAGE ZONES (Elev. Capacity)										
25	Surcharge	1142-1147 5,465AF	1121-1127 2,010AF	1128.2-1138.2 7,225AF	1113.1-1125.6 8,128AF						
26	Flood control	1121-1142 13,889AF	1104-1121 3,730AF	1110.0-1128.2 7,585AF	1095.83-1113.1 8,119AF						
27	Multipurpose	1085-1121 3,243AF	1085-1104 1,506AF	1060.5-1110.0 3,475AF	1088-1095.83 2,882AF						
28	Gross storage (Excl. of surcharge)	17,161AF	5,226AF	11,055AF	8,881AF						
	OUTLET WORKS										
29	Number and size — conduits	1 — RCP — 54" diameter	1 — RCP — 36" diameter	1 — RCP — 48" diameter	1 — RCP — 48" diameter						
30	Conduit length — ft.	680	738	787	656						
31	Discharge capacity at conduit — CFS (at top of F.C. Pool)	570	160	490	490						
32	Gated outlets (No. — size — invert elev. of intake in ft. MSL)	1 — 30"x 30" 1160	1 — 24" x 36" 1080.0	1 — 30"x 30" 1080.0 1 — 8" diameter 1104.25	1 — 30" x 30" diameter 1027.0 1 — 8" diameter 1060.0						
33	Discharge capacity of gated outlets — CFS (at base of F.C. Pool)	90	90	140	140						
34	Ungated outlets (No. — size — invert elev. — ft. MSL)	2 — 2.0'x 4.0' 1121 2 — 3.5'x 9.0' 1123.5	2 — 1.0'x2.5' 1104.0 2 — 2.0'x 6.0' 1106.0	2 — 1.5'x3.5' 1110.0 2 — 3.15'x6.0' 1117.0	2 — 1.25'x3.5' 1095.83 2 — 3.67'x 6.0 1103.4						
35	**POWER INSTALLATION**	None	None	None	None						

(1) Cost as of 9-3-86

(2) Based on a survey of July 1987 the elevation of the overflow top was changed from 1096.0 ft. MSL to 1095.83 ft. MSL

SUMMARY OF ENGINEERING DATA — FEDERAL RESERVOIRS WITH AUTHORIZED FLOOD CONTROL
MISSOURI RIVER TRIBUTARIES — U.S. ENGINEER DISTRICT — OMAHA
BUREAU OF RECLAMATION DAMS

ITEM NO	SUBJECT	BOYSEN	CANYON FERRY	CLARK CANYON	GLENDO	HEART BUTTE	JAMESTOWN	KEYHOLE	PACTOLA	SHADEHILL	TIBER	YELLOWTAIL
	GENERAL											
1	Location of dam	20 mi. S. of Thermopolis, Wy.	17 mi. N.E. of Helena, Mont.	19 mi. S.W. of Dillon, Mont.	4.5 mi. S.E. of Glendo, Wyo.	15 mi. S. of Glen Ullin, N.D.	1 mi. N. of Jamestown, N.D.	12 mi. N.E. of Moorcroft, Wyo.	15 mi. W. of Rapid City, S.D.	1 mi. W. of Shadehill, S.D.	19 mi. S.W. of Chester, Mont.	45 mi. S.W. of Hardin, Mont.
2	River and mileage	Wind R.M. 295	Missouri R.M. 2253	Beaverhead	North Platte R.M. 290	Heart R.M. 103.5	James R.M. 580	Belle Fourche R.M. 289	Rapid Cr R.M. 110	Grand R.M. 95	Marias R.M. 77	Bighorn
3	Drainage area in square miles	7710	15900	2370	14330	1710	1500	1950	319	3120	4950	15,626
4	Reservoir length in miles	17.5 at el. 4725	25 at el. 3860	5 at el. 5590.4	15 at el. 4635	12 at el. 2094.5	40 at el. 1454	10 at el. 4111.4	6.5 at el. 4621.5	10 at el. 2302	25 at el. 3912.5	71 at el. 3657
5	Location of Dambender	On site	On site	Dillon, Mont.	On site	On site	none	Pactola Dam	On site	none	On site	On site
6	Travel time to Missouri River	6 days	4.5 days to Ft. Peck	2.5 days to Three Forks	About 2 weeks	2 days	About 7 weeks	5 days	3 days	2 days	1.25 days	4 days
7	Max. discharge of record	29,800 cfs Jul. 1923	47000 cfs Jun. 1908	3770 CFS Jun. 1908	30,000 cfs Jun. 1908	30,500 cfs May 1979	± 8000 cfs Apr. 1986	12,000 cfs Apr. 1924	2200 cfs May 1952	58,000 cfs Apr. 1950	40,000 cfs Jun. 1948	37,400 cfs Jun. 1935
8	Project cost (1)	$33,498,000	$42,546,600	$12,108,000	$44,371,000	$3,576,000	$3,717,000	$4,722,000	$7,861,000	$7,269,000	$44,909,000 (1983)	$95,900,000
	DAM AND EMBANKMENT											
9	Top of dam — ft. MSL	4758.0	3886.5	5578.0	4675.0	2124.0	1471.0	4134.0	4655.0 (3)	2318.0	3076.0	3680.0
10	Length at dam — ft.	1143	1090	2950	2098	1850	1418	3420	5280	12,840	4380	1450
11	Height at dam — ft.	150	226	147.5	167	124	85	118	245	122	201	524
12	Stream bed — ft. MSL	4608	3635.5	5446.5	4506	2000	1386	4016	4422	2196	2823.5	3168
13	Abutment formation	Sandstone — shale — limestone	Shale — slate	Sand — bentonitic tuff	Sandstone — shale	Sandstone	Pierre shale	Sandstone and shale	Slate and schist	Sand, silt and clay	Shale and sandstone	Limestone
14	Type of dam	Rolled earth	Concrete gravity	Rolled earth	Rolled earth	Rolled earth	Rolled earth	Rolled earth and rock	Rolled earth and rock	Rolled earth	Rolled earth	Concrete thin arch
15	Fill quantity in cu. yds.	1,527,000	407,100	1,884,000	2,676,000	1,140,000	983,000	1,329,000	4,532,000	3,391,000	12,049,000	1,348,000
16	Date of closure	Oct. 1951	Mar. 1953	Aug. 1964	Jun. 1958	Aug. 1949	May 1953	Mar. 1952	Aug. 1956	Jul. 1950	Oct. 1950	Dec. 1966
17	Date of initial fill (top of conser. pool)	Jun. 1952	Jul. 1956	Jun. 1965	May 1959	Apr. 1950	Apr. 1985	May 1978	Jun. 1953	Apr. 1952	Aug. 1954	Jun. 1967
	SPILLWAY											
18	Discharge capacity — cfs (Max. pool)	20,000 at el. 4725	150,000	9530	10,300	5830	2930	11600	255,000	(Service) 5700 127,000 cfs	68,470	92600
19	Crest elev. — ft. MSL	4700.0	3766.9	5580.4	4653.0	2094.5	1454	4099.3	4621.5	2271.9 2302.0	2975.0	3683.0
20	Width — ft.	60 (net) 80 (total)	204 (net) 222 (gross)	100	45	27	9.5	18.25	425	— 1500	66	56 (net)
21	Gates, number, size, type	2 (30x25 ft) radial	4 (51x34.5 ft) radial	Ungated chute	Ungated ogee weir	Ungated glory hole	Ungated glory hole	Ungated ogee weir	Ungated ogee weir	Ungated Ungated Early type earth cnannel	3 — 22x36 ft. radial	2 — 25x64.4 ft. radial
	RESERVOIR ELEV. AND AREA											
22	Maximum pool	4752.0 30,860a	3800.0 33,535a	5571.9 6600a	4669.0 23,300a	2118.2 10,950a	1464.4 17,430a	4128.7 10,730a	4651.7 1,580a	2312.0 12,150a	3020.2 25,410a	3660.0 17,946a
23	Top of flood control pool	4732.2 22,170a	3800.0 33,535a	5590.4 5900a	4653.0 17,900a	2094.5 6,540a	1454.9 13,210a	4111.5 13,730a	4621.5 1,230a	2302.0 9900a	3012.5 23,150a	3657.0 17,280a
24	Top of joint use pool	4725.0 19,560a	3797.0 32,800a	5548.1 5180a	—	—	1432.67 2,580a	—	—	—	2993.0 17,690a	3640.0 12,600a
25	Top of conservation pool	4717.0 16,980a	3770.0 24,125a	5535.7 4495a	6635.0 12,370a	2084.5 3,400a	1429.8 2,050a	4099.3 9,410a	4580.2 800a	2271.9 4800a	2976.0 13,795a	3614.0 9915a
26	Top of inactive pool	4685.0 9,280a	3728.0 11,480a	5470.8 220a	6570.0 3,130a	2030.0 800a	1400.0 160a	4051.0 820a	4456.1 100a	2250.6 2900a	2966.4 11,710a	3547.0 4150a
	STORAGE ZONES (Elev. Capacity)											
27	Surcharge zone	4732.2-4752.0 526,700AF	none	5580.4-5671.9 71,830AF	4653.0-4669.0 376,300AF	2094.5-2118.2 208,400AF	1454.0-1464.4 158,900AF	4111.5-4128.7 294,800AF	4621.5-4651.2 43,692AF	2302.0-2312.0 111,200AF	3012.5-3020.2 167,740AF	3657.0-3680.0 52,830AF
28	Exclusive flood control zone	4725.0-4732.2 156,400AF	3797.0-3800.0 99,460AF	5548.1-5580.4 78,090AF	4635.0-4653.0 271,800AF	2084.5-2094.5 147,600AF	1432.7-1454.0 106,480AF	4099.3-4111.5 140,500AF	4580.2-4621.5 43,057AF	2271.9-2302.0 218,300AF	2993.0-3012.5 400,900AF	3640.0-3657.0 258,330AF
29	Joint use zone	4717.0-4725.0 146,100AF	3770.0-3797.0 795,135AF	5535.7-5548.1 90,440AF	none	none	1429.8-1432.7 8,660AF	none	none	none	2976.0-2993.0 298,060AF	3614.0-3640.0 240,340AF
30	Conservation zone	4685.0-4717.0 403,800AF	3728.0-3770.0 711,460AF	5470.8-5535.7 126,120AF	4570.0-4635.0 454,300AF	2030.0-2084.5 69,000AF	1400.0-1429.8 28,100AF	4051.0-4099.3 185,800AF	4456.1-4580.2 54,955AF	2250.6-2271.9 80,900AF	2966.4-2976.0 121,780AF	3547.0-3614.0 338,100AF
31	Inactive zone	4608.0-4685.0 252,100AF	3635.5-3728.0 445,455AF	5446.5-5470.8 1,510AF	4506.0-4570.0 83,200AF	2000.0-2030.0 6,800AF	1386.0-1400.0 820AF	4016.0-4051.0 8,600AF	4422.0-4456.1 1,017AF	2196.0-2250.6 58,200AF	2823.5-2966.4 577,620AF	3186.9-3547.0 483,580AF
32	Gross Storage (Excl. of surcharge)	952,460AF	2,051,520AF	257,190AF	789,460AF	223,800AF	221,000AF	334,200AF	99,929AF	357,400AF	1,555,960AF	1,338,360AF
	OUTLET WORKS											
33	Number and size — conduits	1 — 96 in. I.D. 1 — 53 in. I.D.	4 — 84 in. I.D. 1 — 13 ft. I.D. pump intake	1 — 9 ft. I.D.	1 — 21 ft. I.D.	1 — 83 in. I.D.	1 — 9.5 ft. — 13.5 ft.	1 — 8.5x8.25	1 — 8 ft.	1 — 7 ft. I.D.	1 conduit containing 1 — 72", 1 — 22" pipes	2 — 84 in. 1 — 9.5 ft.
34	Conduit length — ft.	300	84 in. — 115	741	2300	597	443.75	652.4	749	355	72" — 1110 22" — 1090	288 — 218 — 305
35	No. — size — type gates	3 — 48 in. Jet valves	4 — 77 in. Slide 9500	2 — 3x6.5 ft. Slide	3 — 7.25x7.75 ft. Slide	1 — 4x5 ft. Slide	2 — 5x8 ft. Slide	2 — 3.5x3.5 ft. Slide	2 — 2.75x2.75 ft. Slide	1 — 6x8 ft. radial	1—30" Slide, 1 — 18" butterfly	3 — bulkhead gates
36	Disch. capac. — cfs (At base of EPC zone)	66 in. — 640 57 in. — 670	1 — 13 ft. dia. 800 3 — 13.5 ft. dia. 5,970	2200	11,300	880	2175 at el. 1429.8	1250	1020	600 at el. 2250	1425 at el. 2993 Auxiliary Outlet (2) footnote	84 in. — 2500 each 9 x 9 ft. — 852
	POWER INSTALLATION											
37	No. and size of turbines	2 — 10,500 HP	3 — 23,500 HP	none	2 — 16,750 HP	none	none	none	none		none	4 — 87,500 HP
38	No. and rating of generators	2 — 7500 KW	3 — 16,667 KW		2 — 12,000 KW							4 — 62,500 KW
39	Plant capacity	15,000 KW	50,000 KW		24,000 KW							250,000 KW
40	Power Plant disch. capac. (At base of EPC zone)	2300 cfs	5700 cfs		3300 cfs							7800 cfs

(1) These costs to complete the dam and reservoir, the associated recreation and fish and wildlife facilities and the power plant were applicable. Costs do not include irrigation facilities except those located at the dam. Costs are as of 9-30-79.

(2) TIBER AUXILIARY OUTLET

No. and size of conduits	1 — 10.75 ft. I.D.
Conduit length — ft.	1535
No. — Size — Type gates	1 — 7.25x8.25 ft. slide 2 — 7.0x12.0 ft. slide
Discharge capacity — cfs	4250 at el. 3020.2

(3) Pactola Dam was raised 15 feet in 1967

October 1986

PERTINENT DATA

SPRING CREEK DAM
(LAKE POCASSE)

Location - On Spring Creek arm of Lake Oahe, at Pollock, South Dakota

Purpose - It is a road relocation route for the area inundated by Lake Oahe. Control structures are provided to regulate Lake Pocasse for fish and wildlife, and recreation.

Drainage Area - 660 sq. mi. (224 sq. mi. of which is non-contributing).

Dam and Embankment

Type of Fill - Rolled Earth
Top of Dam Elev. - 1625 ft. MSL
Length of Dam - 3,200 ft.
Height of Dam - 40 ft. maximum
Streambed - 1585 ft. MSL
Date of Closure - 1961
Date of Initial Fill - Between 1961 and 1964

Spillway - Nine 6 x 8 ft. uncontrolled box culverts with a crest elevation of 1617 ft. MSL.

Reservoir Elevations, Area and Capacity

	Ft. MSL	Acres	Acre-Feet
Top of Embankment	1625	2,560	26,000
Spillway Crest	1617	1,520	11,000
Top of Mid-level Outlet	1614	1,130	7,000
Invert of Mid-level Outlet	1609	500	3,440
Invert of Low-level Outlet	1602	60	1,000
Streambed	1585	0	0

Outlet Works - One 5 ft. CMP conduit with a 5 x 5 ft. sluice gate, invert elev. 1602 and a 5 x 12 ft. overflow roller gate, invert elev. 1609.

PERTINENT DATA

SNAKE CREEK DAM
(LAKE AUDUBON)

Location - On Snake Creek arm of Lake Sakakawea, approximately 12 miles northeast of Garrison Dam, North Dakota.

Purpose - The dam and reservoir are a relocation route for transportation facilities and utilities which were inundated by Lake Sakakawea, a regulating reservoir for the Bureau's Garrison Diversion Unit, and provide for fish and wildlife, and recreation.

Drainage Area - 250 sq. mi. (110 sq. mi. of which is non-contributing).

Dam and Embankment

Type of Fill - Rolled Earth
Top of Dam Elev. - 1865 ft. MSL
Length of Dam - 12,900 ft.
Height of Dam - 85 ft. maximum
Streambed - 1780 ft. MSL
Date of Closure - 1952
Date of Initial Fill - Sept. 1975

Spillway - None (An original designated ungated spillway of 3 - 60" culverts with a crest of elevation of 1850 was filled in and closed in 1972 when the embankment was widened to provide for a four lane highway. It was located 180 ft. north of regulating conduit).

Reservoir Elevations, Area and Capacity

	Ft. MSL	Acres	Acre-Feet
Maximum Normal Operating Pool	1850	20,620	396,000
Minimum Normal Operating Pool	1847	18,780	336,870
Top of Inactive Pool	1810	1,450	13,180
Streambed	1780	0	0

Outlet Works - A 7 x 10 ft. reinforced concrete conduit, invert elev. 1810, regulated by a 7 x 10 ft. sluice gate. An external crane is required to operate the gate. Located about 3,000 ft. south of north end of main embankment. Discharge capacity 2,300 c.f.s. under 15 ft. head differential. Two 7 x 10 ft. bulkheads one on each side of sluice gate. Stilling basin on Garrison side.

TOTAL NUMBER

OF

FLOOD CONTROL RESERVOIRS

IN OMAHA DISTRICT

TOTAL NUMBER OF FLOOD CONTROL RESERVOIRS IN THE OMAHA DISTRICT
MONITORED AND/OR REGULATED AND REPORTED BY THE RESERVOIR REGULATION SECTION

AS OF 1 JAN	MAIN STEM	TRIBUTARY C.E.	TRIBUTARY U.S.B.R.	TOTAL*
1937	0	0	0	0
1938	1 (Ft.Peck)	0	0	1
1939-48	1	0	0	1
1949	1	1 (Cherry Creek)	0	2
1950	1	1	1 (Heart Butte)	3
1951	1	1	3 (Shadehill, Tiber)	5
1952	1	1	4 (Boysen)	6
1953	2 (Ft Randall)	2 (Cold Brook)	5 (Keyhole)	9
1954	3 (Garrison)	3 (Kelly Road)	6 (Jamestown)	12
1955	3	3	6	12
1956	4 (Gavins Pt)	4 (Bull Hook-Scott Coulee)	6	14
1957	4	4	8 (Glendo, Pactola)	16
1958	4	4	8	16
1959	5 (Oahe)	4	8	17
1960	5	5 (Cedar Canyon)	8	18
1961	5	5	8	18
1962	5	5	8	18
1963	5	8 (Salt Creek)	8	21
1964	6 (Big Bend)	11 (Salt Creek)	8	25
1965	6	12 (Salt Creek)	9 (Clark Canyon)	27
1966	6	14 (Salt Creek)	9	29
1967	6	15 (Bowman-Haley)	11 (Yellowtail,Canyon Ferry)	32
1968	6	16 (Salt Creek)	11	33
1969	6	16	11	33
1970	6	17 (Cottonwood Springs)	11	34
1971-73	6	17	11	34
1974	6	20 (Pipestem,Chatfield,Papio)	11	37
1975	6	21 (Papio)	11	38
1976	6	21	11	38
1977	6	21	11	38
1978	6	22 (Bear Creek)	11	39
1979-82	6	22	11	39
1983	6	23 (Papio)	11	40
1984	6	24 (Papio)	11	41
1985-92	6	24	11	41

*Two Subimpoundments (Lake Pocasse and Snake Creek) are not included.

REGULATION SHEETS

FOR

PAST YEARS

CORPS OF ENGINEERS PROJECTS

1. BEAR CREEK DAM
2. BOWMAN-HALEY DAM
3. BULL HOOK DAM
4. CEDAR CANYON DAM
5. CHATFIELD DAM
6. CHERRY CREEK DAM
7. COLDBROOK DAM
8. COTTONWOOD SPRINGS DAM
9. KELLY ROAD DAM
10. WESTERLY CREEK
11. PAPILLION DAM NO. 11
12. PAPILLION DAM NO. 16
13. PAPILLION DAM NO. 18
14. PAPILLION DAM NO. 20
15. PIPESTEM DAM
16. SALT CREEK DAM NO. 2
17. SALT CREEK DAM NO. 4
18. SALT CREEK DAM NO. 8
19. SALT CREEK DAM NO. 9
20. SALT CREEK DAM NO. 10
21. SALT CREEK DAM NO. 12
22. SALT CREEK DAM NO. 13
23. SALT CREEK DAM NO. 14
24. SALT CREEK DAM NO. 17
25. SALT CREEK DAM NO. 18
26. SNAKE CREEK DAM
27. SPRING CREEK DAM

BEAR CREEK DAM AND LAKE
BEAR CREEK, SOUTH PLATTE RIVER BASIN, COLORADO
1991-1992 REGULATION

The Omaha District entered into two temporary one year storage contracts for municipal and industrial water supply under Section 6 of the Flood Control Act of 1944 (Public Law 34, 78th Congress), pending development of a long-term contract under the Water Supply Act of 1958 as amended (43 U.S.C. 390 b-f). The first contract dated September 17, 1987 was for 25 acre feet with the Indian Hills Water District. This contract was renewed in April 1991. The cost of storage per acre-foot in each of these contracts is approximately $2700.00.

In response to the contracts for temporary water storage, a revised Memorandum of Understanding (MOU) between the Corps of Engineers and the State of Colorado was signed on June 20, 1988. This memorandum supersedes the previous MOU dated May 11, 1977. Under normal conditions the Bear Creek Dam outlet works is set to automatically pass streamflow up to 500 cfs when pool elevations are above the drop inlet-outlet weir crest of 5558 feet MSL. When conditions warrant, higher releases are made by opening two slide service gates in the dome type gated control structure buried under the embankment. Under the revised MOU, the State Engineer or his representative will determine the storage and releases necessary to satisfy downstream water right requirements when the pool level is below elevation 5559 ft. MSL. Elevation 5559 is one foot into the flood storage zone and was selected to allow flexibility in targeting authorized pool levels. Bear Creek Reservoir was not made operational during the reporting period as has been done in the past.

The State of Colorado, Department of Natural Resources, Division of Game, Fish and Parks, in a letter dated October 1, 1970, agreed to provide water for the initial filling and replenishment of evaporation losses from the recreation pool, by purchase or other means, consistent with Federal and State laws to assure effective operation of the project for recreation.

In January 1992, the Denver Regional Council of Governments (DRCOG) requested Corps of Engineers participation in a demonstration project at Bear Creek Reservoir using hypolimnetic withdrawals throughout the year. The water quality in the reservoir and downstream of the reservoir would be monitored to assess the effectiveness of this management practice on water quality. The Corps of Engineers would make variable releases throughout the year depending on the inflow. The table on the following page shows the approximate release targets as requested by DRCOG.

STREAM FLOW	RELEASE
> 20 cfs	10 cfs
15 - 20 cfs	7 - 9 cfs
10 - 15 cfs	5 - 6 cfs
< 10 cfs	0 cfs

Release changes were made weekly as needed throughout the year and will continue through December 1992.

Runoff during the reporting period was 79 percent of normal. Snowmelt runoff occurred during February and March with inflows reported at 79 percent of the historic average. A total of 188 AF or .7 percent of the 28,757 AF flood storage zone was utilized at the maximum pool elevation of 5559.70 on August 1. No flood control was achieved during this period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	910 cfs May 01 80	800 cfs May 5-12 80
2nd	690 cfs Jun 10 79	800 cfs Jun 12 79
3rd	625 cfs May 23 83	605 cfs Jun 29 - Jul 02 83

	Pool-Date
Highest	5581.0 Jun 23 83
2nd	5576.3 May 19 80
3rd	5567.9 Jun 10 79

Minimums of Record (since initial fill):

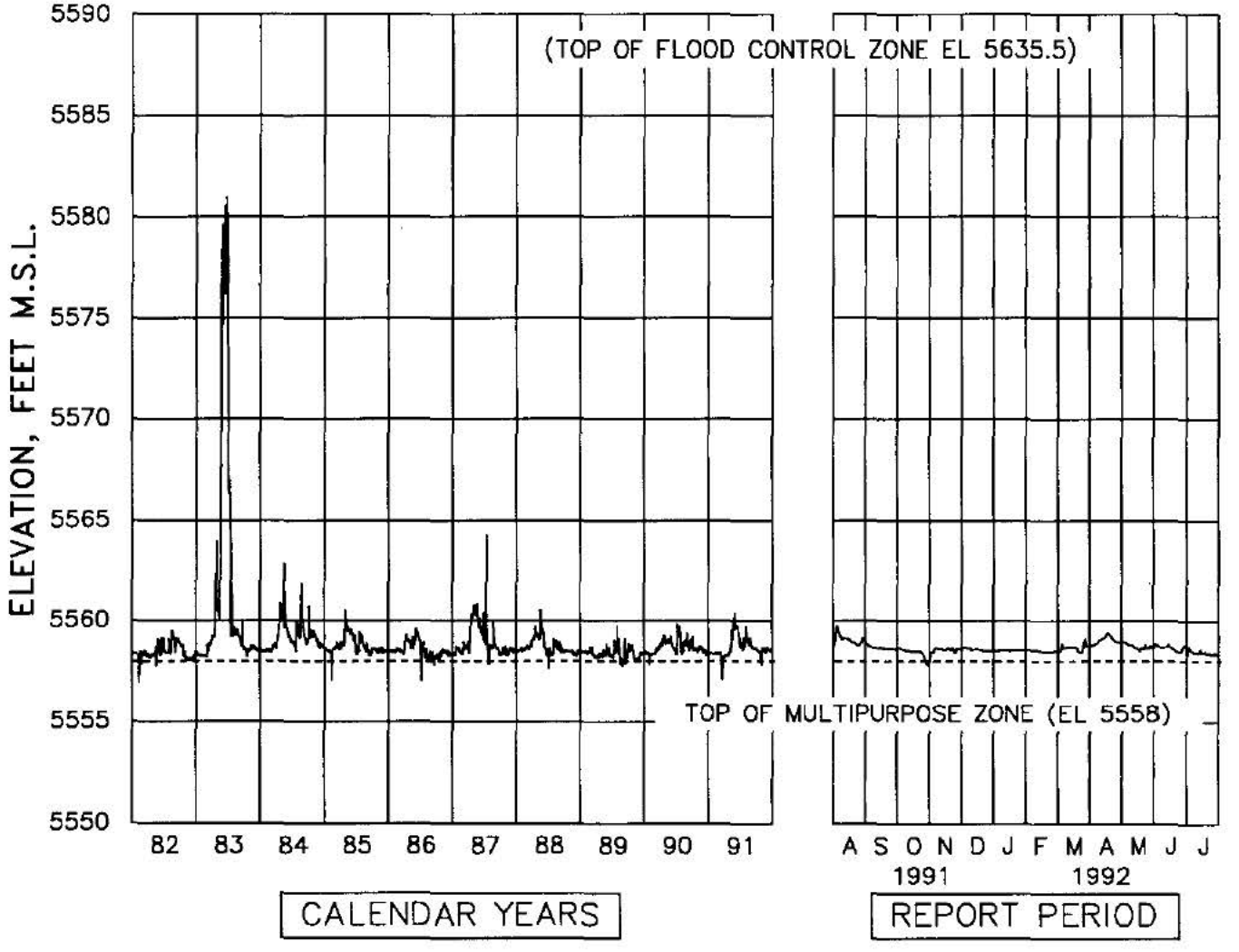
	Pool-Date
Lowest	5556.98 Feb 09 82
2nd	5557.08 Jul 09 86

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
31,404, 79% of normal	31,153, 79% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
170, Aug 04	167, Aug 04
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
5559.70, Aug 01	5557.80, Oct 29

BEAR CREEK DAM AND LAKE
BEAR CREEK, SOUTH PLATTE RIVER BASIN, COLORADO
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



BOWMAN HALEY DAM AND LAKE
GRAND RIVER BASIN, NORTH DAKOTA
1991-1992 REGULATION

Five consecutive years of drought produced a new record minimum pool of 2747.57 on June 12, 1992. This is the lowest pool since the date of initial fill in 1969.

On June 13, 1992 an intense storm in and near Crooked Creek basin in South Dakota produced up to 10.5 inches of rain and golf- ball sized hail. Runoff from this event resulted in the 2nd highest mean daily inflow on record of 2,135 cfs on June 14. The peak calculated mean hourly inflow was estimated to be approximately 7,000 cfs. The peak instantaneous inflow as determined by the USGS was 12,900 cfs. Crooked Creek discharge was estimated at 12,700 cfs while the North Fork Grand River discharge contributed 200 cfs. Peak discharge of Crooked Creek at U.S. Highway 85, near Ludlow, South Dakota was 12,400 cfs. The complete results of a cooperative study performed by the USGS to determine the areal extent of rainfall that occurred on June 13, 1992, in Harding County, South Dakota and to determine the peak discharge of Crooked Creek caused by the rainfall are located in the Bowman-Haley project file in Water Control Section.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	5,310 cfs Mar 27 78	2,390 cfs Mar 28 78
2nd	2,135 cfs Jun 14 92	1,124 cfs Mar 14 72
3rd	1,770 cfs Mar 11 72	930 cfs Mar 30 71

	Pool-Date
Highest	2762.66 Mar 28 78
2nd	2758.50 Mar 13 72
3rd	2758.08 Mar 30 71

Minimums of Record (since initial fill):

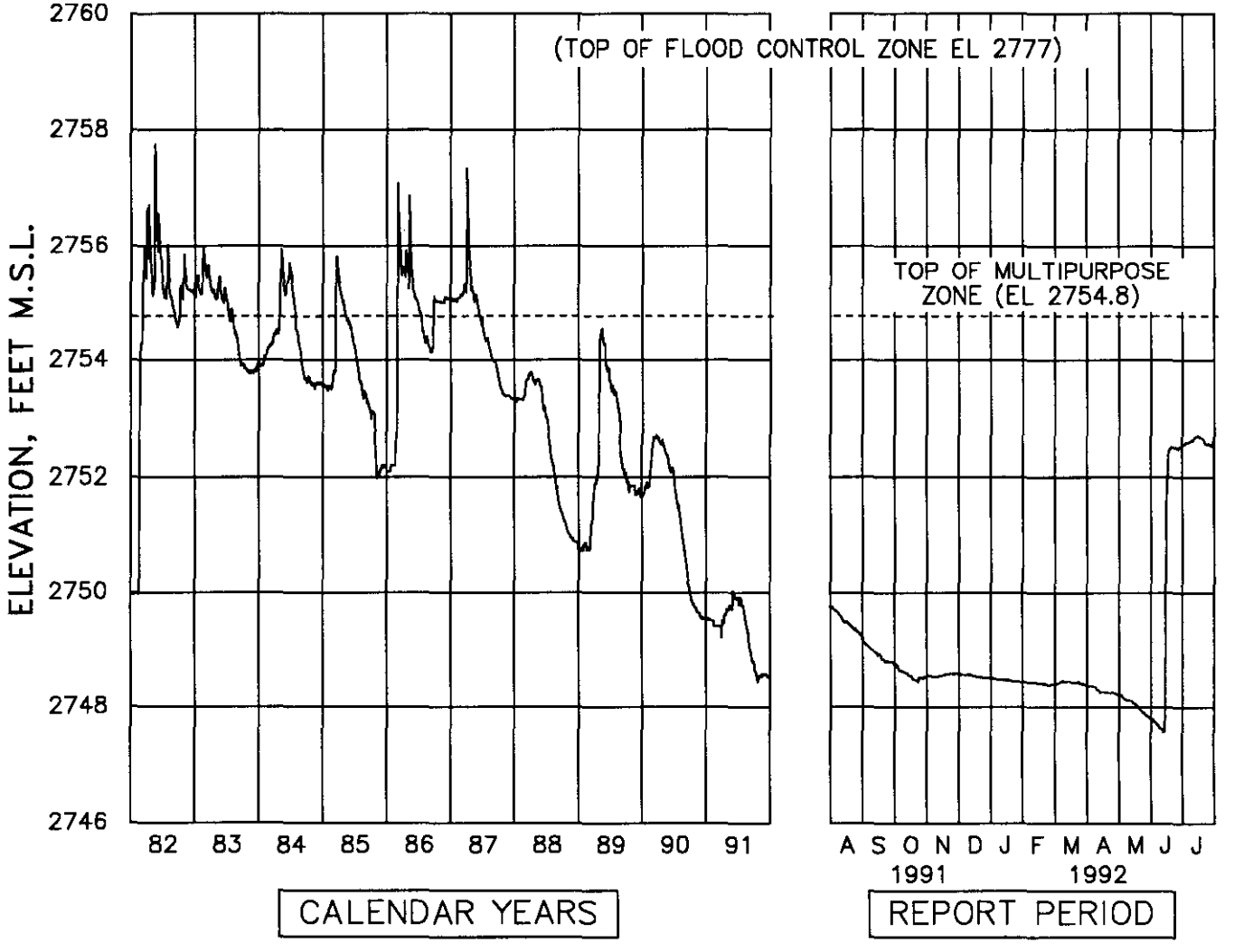
	Pool-Date
Lowest	2747.57 Jun 12 92
2nd	2749.17 Jul 31 91
3rd	2749.93 Nov 16 81

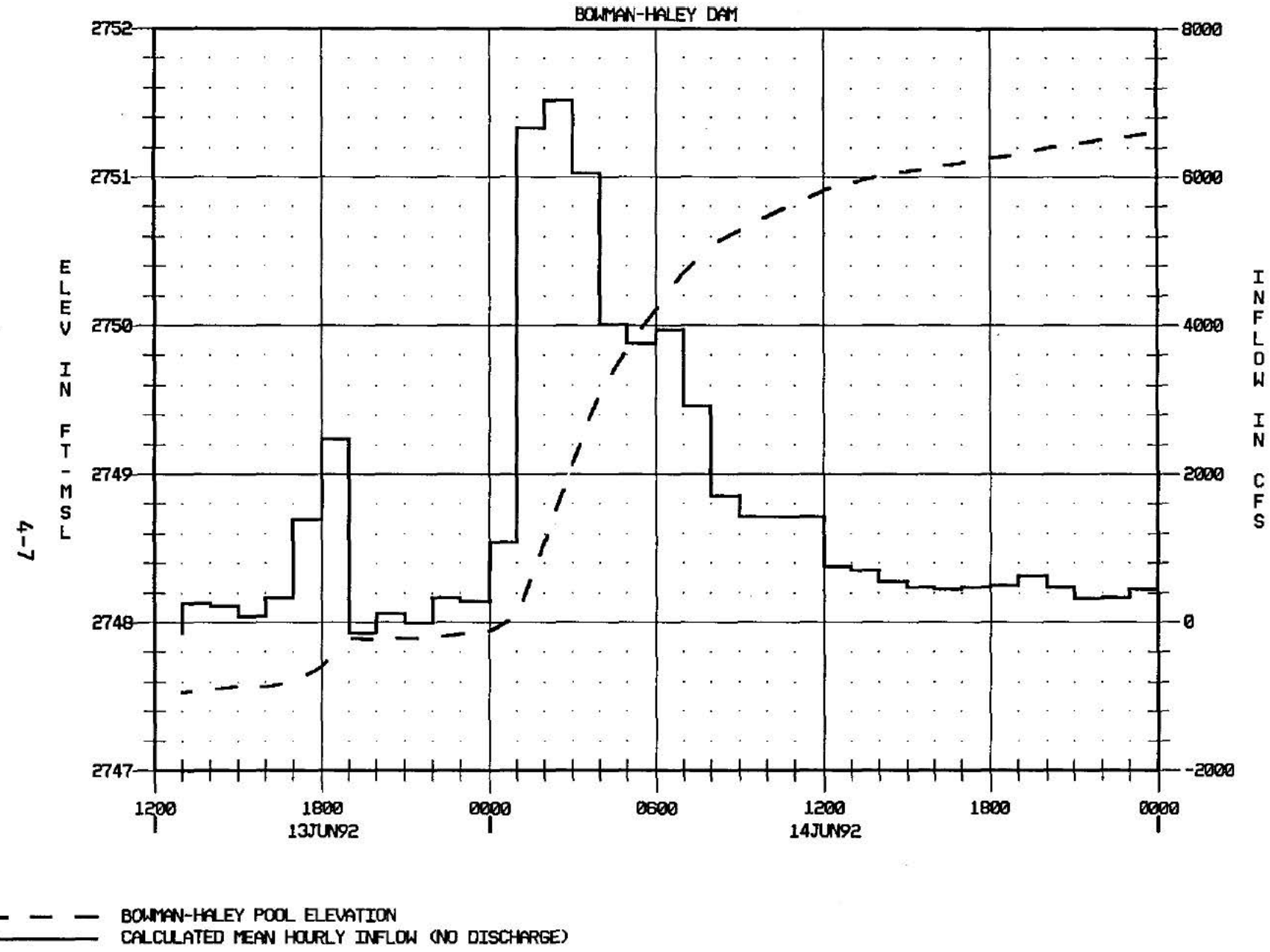
Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
7441, 37% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
2135, Jun 14	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
2752.71, Jul 13	2747.57, Jun 12

BOWMAN–HALEY DAM AND LAKE
GRAND RIVER BASIN, NORTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.




BOWMAN-HALEY DAM
ELEV IN FT-MSL
INFLOW IN CFS
2752
2751
2750
2749
2748
2747
8000
6000
4000
2000
0
-2000
1200
1800
0000
0600
1200
1800
0000
13JUN92
14JUN92
BOWMAN-HALEY POOL ELEVATION
CALCULATED MEAN HOURLY INFLOW (NO DISCHARGE)

BULL HOOK-SCOTT COULEE DAMS
MILK RIVER BASIN, MONTANA
1991-1992 REGULATION

Bull Hook and Scott Coulee Dams are both part of the Bull Hook Unit providing flood control for the city of Havre, Montana. Bull Hook and Scott Coulee dams are both located south of Havre on Bull Hook and Scott Coulee Creeks, respectively.

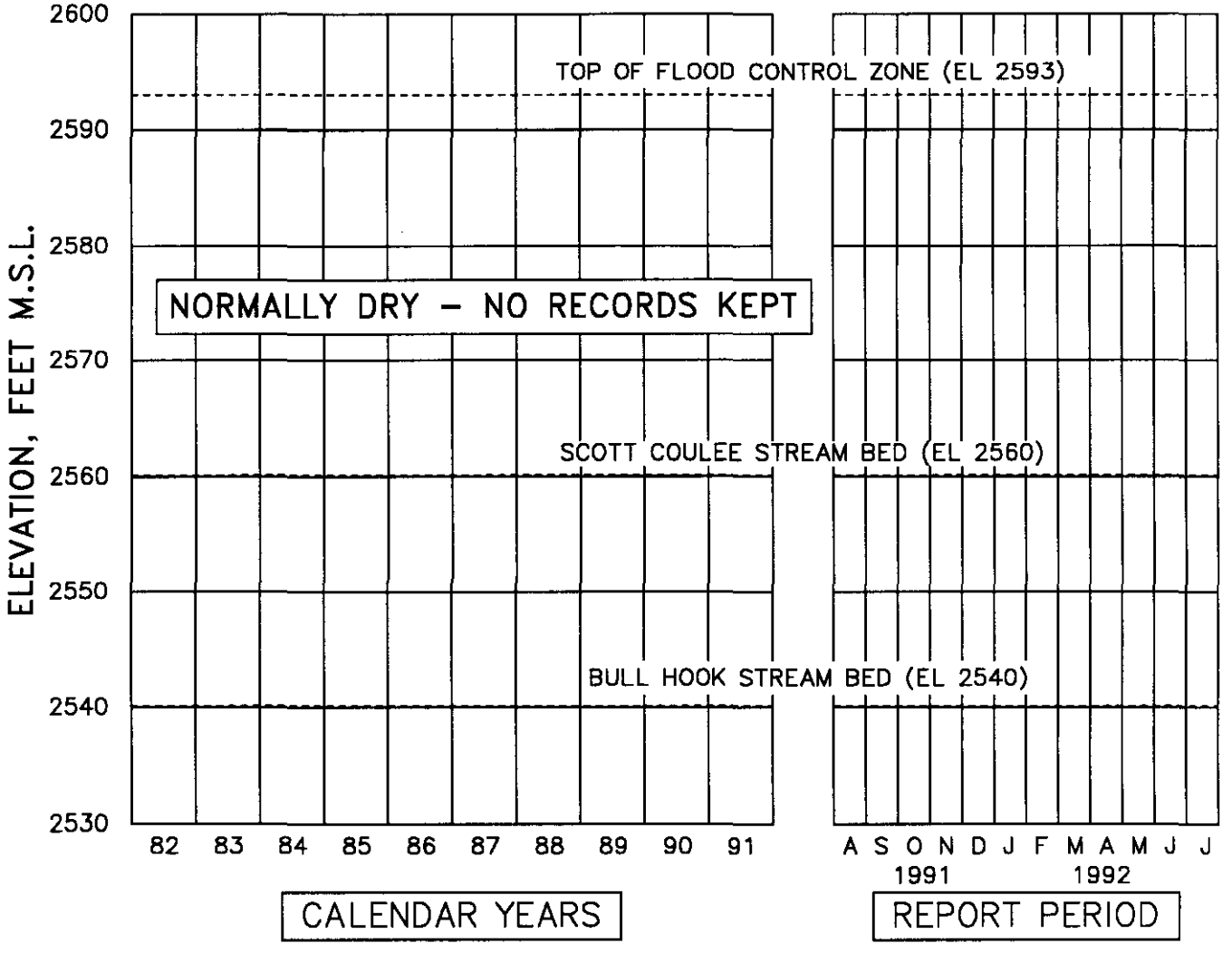
Under normal circumstances, the conduit valves of both dams will be kept partially open to evacuate accumulated storage as expeditiously as possible to allow the dams to function as flood protection facilities if excess runoff occurs upstream. Valve openings are to be maintained that will allow only the minimal damages to occur in the City of Havre.

At times of high flows on the Milk River, it may be necessary to shut off releases in both dams to prevent flooding behind the Milk River levees.

On July 23, 1992 an intensive storm passed over the Scott Coulee drainage basin and Havre, Montana. The storm lasted about 30 minutes and produced rain and golf ball sized hail. Street flooding occurred in Havre. With the gate closed, Scott Coulee Dam backed up water to an estimated depth of 10 feet. After flood waters had receded in Havre, the gate was opened in Scott Coulee and the impoundment drained. It took approximately two weeks to drain. Inflows were estimated as high as 340 cfs.

BULL HOOK – SCOTT COULEE DAMS
MILK RIVER BASIN, MONTANA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.

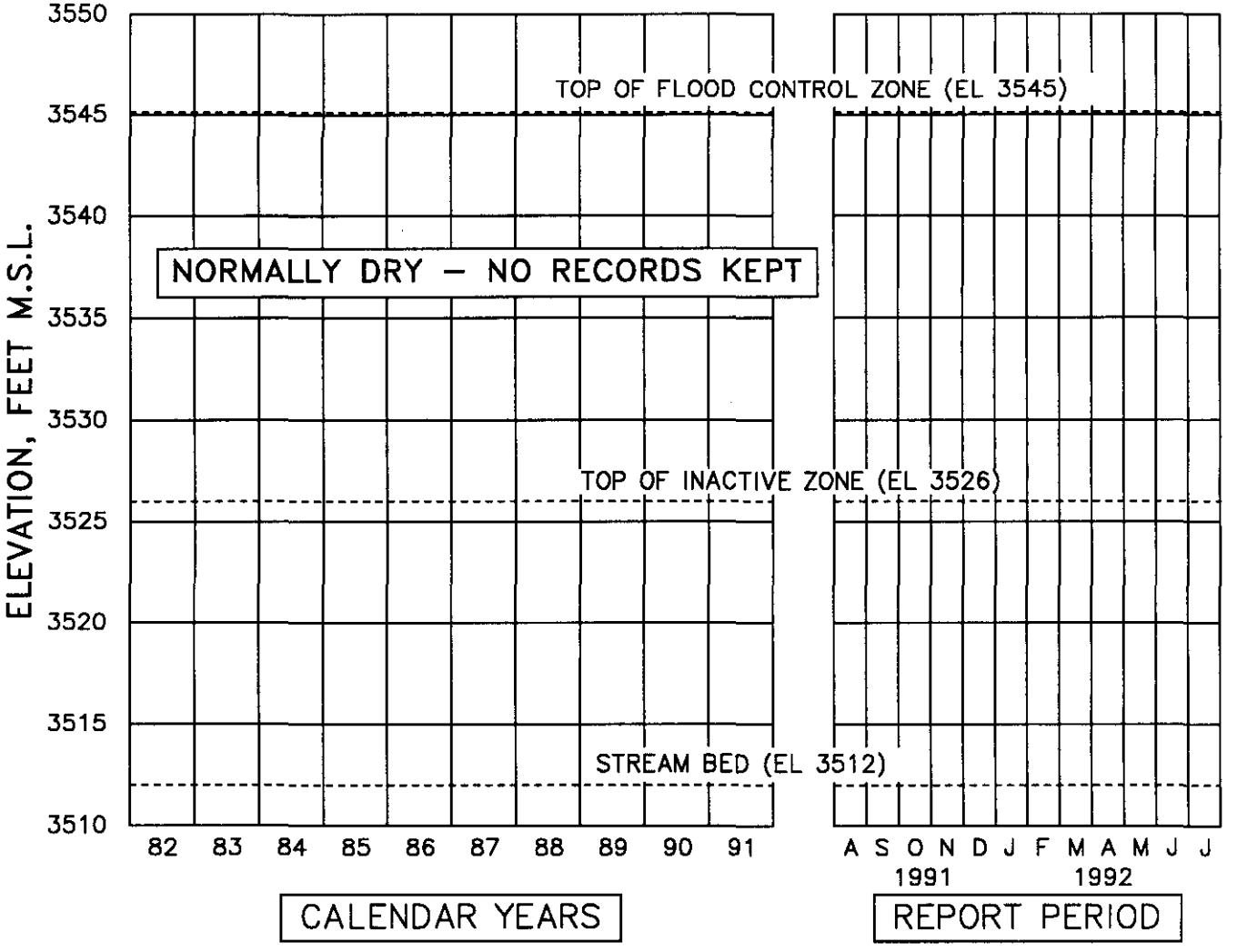


CEDAR CANYON DAM (RED DALE GULCH)
RAPID CREEK BASIN, SOUTH DAKOTA
1991-1992 REGULATION

Cedar Canyon Dam is located on the western outskirts of Rapid City, South Dakota. The dam is designed as a detention structure with no permanent storage, however, a small pool may sometimes exist in the dead storage below the invert of the outlet pipe. The dam collects runoff from approximately 261 acres. The outlet and spillway are uncontrolled. No water accumulated during the report period. Inflow was negligible and outflow was zero for the period. No flood control was achieved.

CEDAR CANYON DAM (RED DALE GULCH)
RAPID CREEK BASIN, SOUTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



CHATFIELD DAM AND LAKE
SOUTH PLATTE RIVER BASIN, COLORADO
1991-1992 REGULATION

Before the dam became operational, the Corps (CEMRO-ED-HC) requested that the Colorado State Engineers Office, acting through the District 8 Water Commissioner, assume responsibility for determining releases from the multipurpose pool in an effort to keep the Corps free of water rights conflicts. This relationship was put into a formal document dated March 30, 1973 when the multipurpose pool was increased from elevation 5430 to 5432 ft. MSL and contained water storage commitments by the State. By contract, the State is committed to keeping the pool above elevation 5423 for recreation and fish and wildlife purposes. Since 1979, the City of Denver through the State of Colorado has been permitted to regulate storage in the conservation pool in return for the City's commitment to provide sufficient water in the pool for recreation. The City is committed to keeping 20,000 AF (Elevation 5426.94 ft. MSL) of water in the pool from May 1 through August 31, and permitted to use 10,000 AF of storage space in the reservoir between elevations 5423.8 and 5432.0 ft. MSL. The original top of multipurpose pool level was at elevation 5426 ft. MSL.

The pool entered the flood control zone on March 5 and remained at or above elevation 5432 through April 21, 1992. The total inflow for the reporting period was 81,724 AF (45% of normal).

Flood storage space utilized was 694 AF of 206,945 AF or .3 percent of the flood storage space at the maximum pool elevation of 5432.48 on April 19. No flood control was achieved during this period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	3,370 cfs May 30 83	3,034 cfs May 15 84
2nd	3,155 cfs May 09 80	3,027 cfs May 27 87
3rd	3,030 cfs May 15 84	2,858 cfs Jul 08 83

	Pool-Date
Highest	5447.58 May 26 80
2nd	5447.08 Jun 30 83
3rd	5445.97 Jun 16 83

Minimums of Record (since initial fill):

	Pool-Date
Lowest	5424.33 Nov 21 90
2nd	5424.46 Nov 17 85

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)
81724, 45% of normal

Total Outflow (AF)
80254, 46% of normal

Peak Daily Inflow (CFS)
535, Aug 06

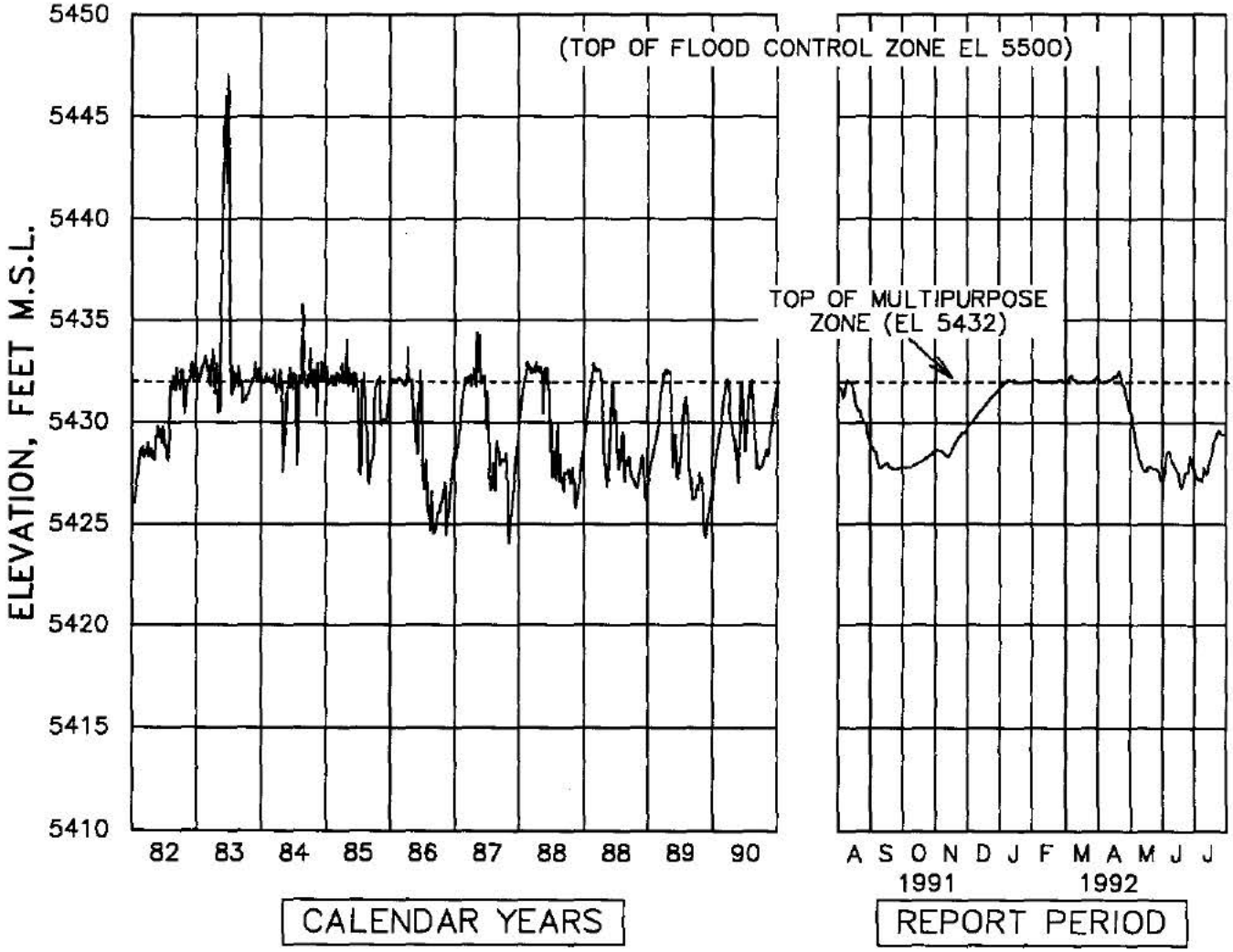
Peak Daily Outflow (CFS)
582, Aug 05

Peak Pool Elevation (Ft. MSL)
5432.48, Apr 19

Minimum Pool Elevation (Ft. MSL)
5426.79, Jun 17

CHATFIELD DAM AND LAKE
SOUTH PLATTE RIVER BASIN, COLORADO
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



CHERRY CREEK DAM AND LAKE
CHERRY CREEK, SOUTH PLATTE RIVER BASIN, COLORADO
1991-1992 REGULATION

Corps of Engineers dams located above populated areas are designed to store and/or pass a Probable Maximum Flood (PMF) without overtopping the embankment. The PMF is estimated using probable maximum precipitation estimates developed by the National Weather Service. The most recent precipitation estimates for this area, published in Hydrometeorological Report No. 55 (HMR 55) in March 1984, were applied to the Cherry Creek Lake project. It was found that the reservoir could safely pass no more than 63 percent of the PMF under existing development with adequate freeboard.

The probability of overtopping of the Cherry Creek embankment is very remote. However, the consequences of failure would be catastrophic.

The PMF was selected as the base safety condition or design goal for the alternatives to be developed in accordance with IWR Report 86-R-7. Downstream from Cherry Creek Dam, the peak discharge for the PMF and floods less than the PMF would increase greatly with dam failure when compared to the nonfailure condition. The population within the potential Cherry Creek flood area downstream from the dam is estimated to be as high as 138,000. Potential flood damages are nearly $3 billion for the with dam failure condition.

A number of alternatives are being considered to enable the project to safely pass the PMF. The alternatives included widening of the existing spillway, adding a new spillway at one of three locations in the embankment, constructing an additional reservoir (Castlewood) about 30 miles upstream from Cherry Creek Lake, hardening the dam face, raising the dam crest, and no action. The alternatives are being considered individually and in combination with each other.

The Reconnaissance Report "Hydrologic Improvement Assessment, Cherry Creek Lake, Colorado", September 1990 has been reviewed by Missouri River Division and is currently under review at Headquarters, USACE. The Feasibility Study process was started in October 1992.

Releases from the project are made to evacuate flood control zone storage and to meet downstream calls. The pool has been allowed to rise up to elevation 5552.0,two feet above the normal multipurpose pool elevation, in order to store water for later use in downstream calls and to help make up for evaporation losses. Water was also stored in Chatfield for the same purposes. The State had been notified that this operation would be allowed on a temporary basis only until an investigation and an environmental assessment were completed.

On July 25, 1988, the Omaha District received a request from the Colorado Department of Natural Resources to raise the conservation pool level at Cherry Creek Reservoir to elevation 5552.0 ft. MSL. This change would allow the Department of Natural Resources to fully use the storage right that they hold and would provide some operational flexibility to store early spring runoff and deliver it at a later date. The Corps has denied this request due to the hydrologic deficiencies of the project.

On June 4, 1992 the Colorado Water and Conservation Board at the request of the Colorado Division of Parks and Outdoor Recreation requested to store 752 AF of water (approximately .5 feet) in the flood control zone at Chatfield Reservoir. The water would be captured during the spring when free water was available and released to satisfy calls on Cherry Creek. The Corps of Engineers' response to the Colorado Water conservation Board outlines the steps that must be done in order to pursue this request. The process could take several years.

Inflows to Cherry Creek Reservoir for the reporting period were 119% of average (9235 AF). Inflows peaked in June with 3287 AF entering the reservoir.

The flushing operation to remove sediment from the intake structure was accomplished on May 19-20. Releases consisted of 240 cfs for 15 minutes from each gate. Sediment within the intake structure around the gates was successfully removed during the exercise.

Urban Drainage and Flood Control District continued their work to improve the Cherry Creek channel downstream of the dam during the report period. Several drop structures and channel stabilization projects were added in this reach.

A total of 1,283 AF or about 1.6 percent of the 79,960 AF exclusive flood storage zone was utilized at the maximum pool elevation of 5551.48 on March 31. No downstream flooding was prevented by this project.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	6,150 cfs Jun 16 65	560 cfs Aug 07-08 65
2nd	3,195 cfs May 06 73	375 cfs Jun 08 75
3rd	1,440 cfs Jul 24 83	330 cfs Apr 23 - May 01 83 May 28 - Jun 02 83
	Pool-Date	
Highest	5565.82 Jun 03 73	
2nd	5562.52 Aug 01 65	
3rd	5557.89 Jul 25 83	

Maximum Hourly Inflow: 56,000 cfs 7-8 p.m., June 16, 1965

Minimums of Record (since initial fill):

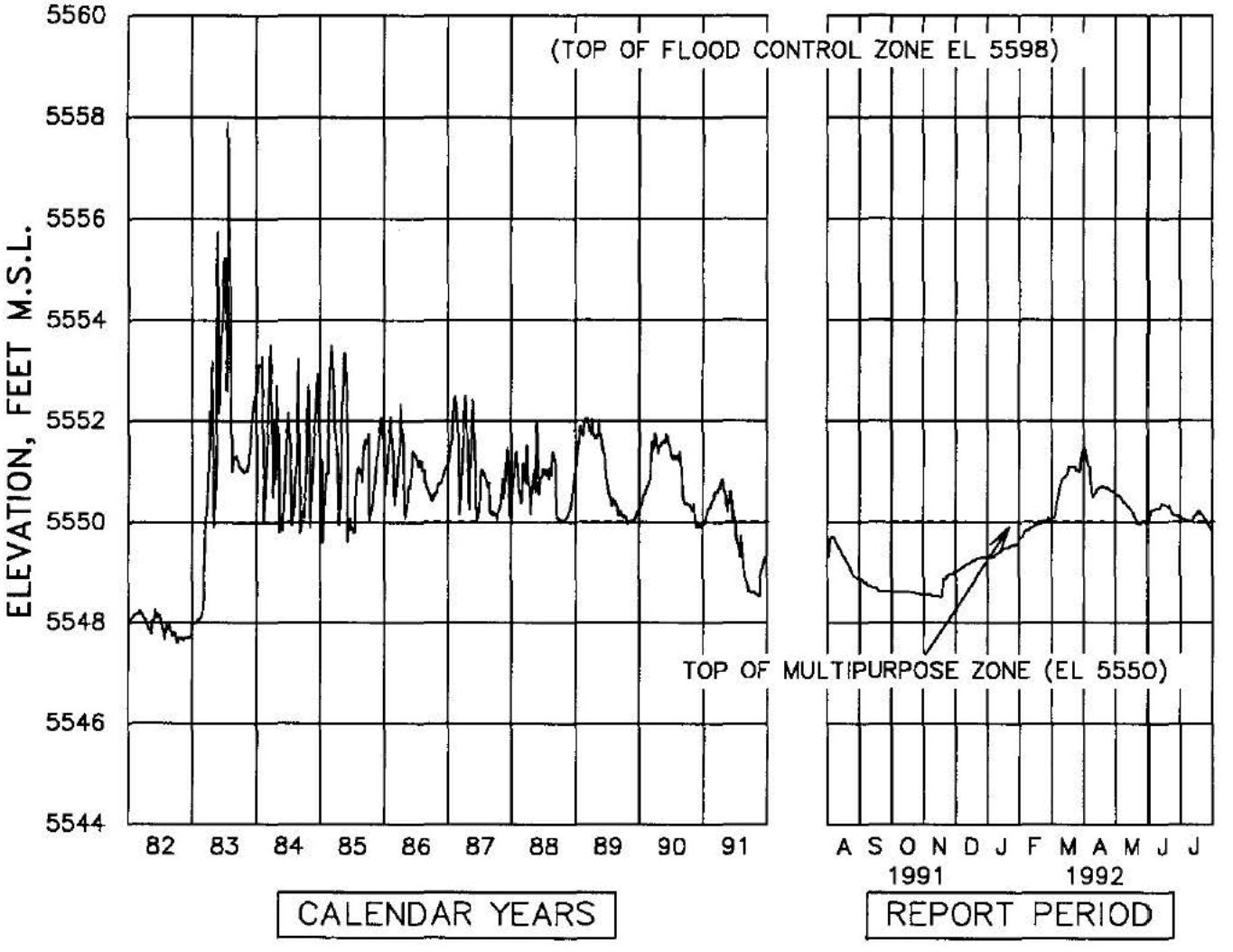
	Pool-Date
Lowest	5543.51 Jan 29 65
2nd	5545.90 Nov 23 - 24 78

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
9235, 119% of normal	6062, 120% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
167, Mar 28	100, Apr 1-8
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
5551.48, Mar 31	5548.52, Nov 13

CHERRY CREEK DAM AND LAKE
CHERRY CREEK, SOUTH PLATTE RIVER BASIN, COLORADO
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



COLD BROOK DAM AND LAKE
FALL RIVER BASIN, SOUTH DAKOTA
1991-1992 REGULATION

Releases from Cold Brook Reservoir are regulated to comply with State water law. Larive Lake Resort, located below the dam, holds a senior water right entitling it to the Cold Brook Reservoir inflow up to 1.1. cfs.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	74 cfs Jul 14 62	2.4 cfs Mar 23 87
2nd	65 cfs Jul 08 61	2.0 cfs May 16-20 72
3rd	40 cfs May 19 82	1.9 cfs Oct 01 72
		Jan 07 73
		Jun 09-11 75
		May 02-07 76

	Pool-Date
Highest	3585.38 Aug 17 82
2nd	3585.26 Jul 22 82
3rd	3585.25 Jan 12 85
	Feb 22-24 85
	Mar 23/May 03 87

Minimums of Record (since initial fill):

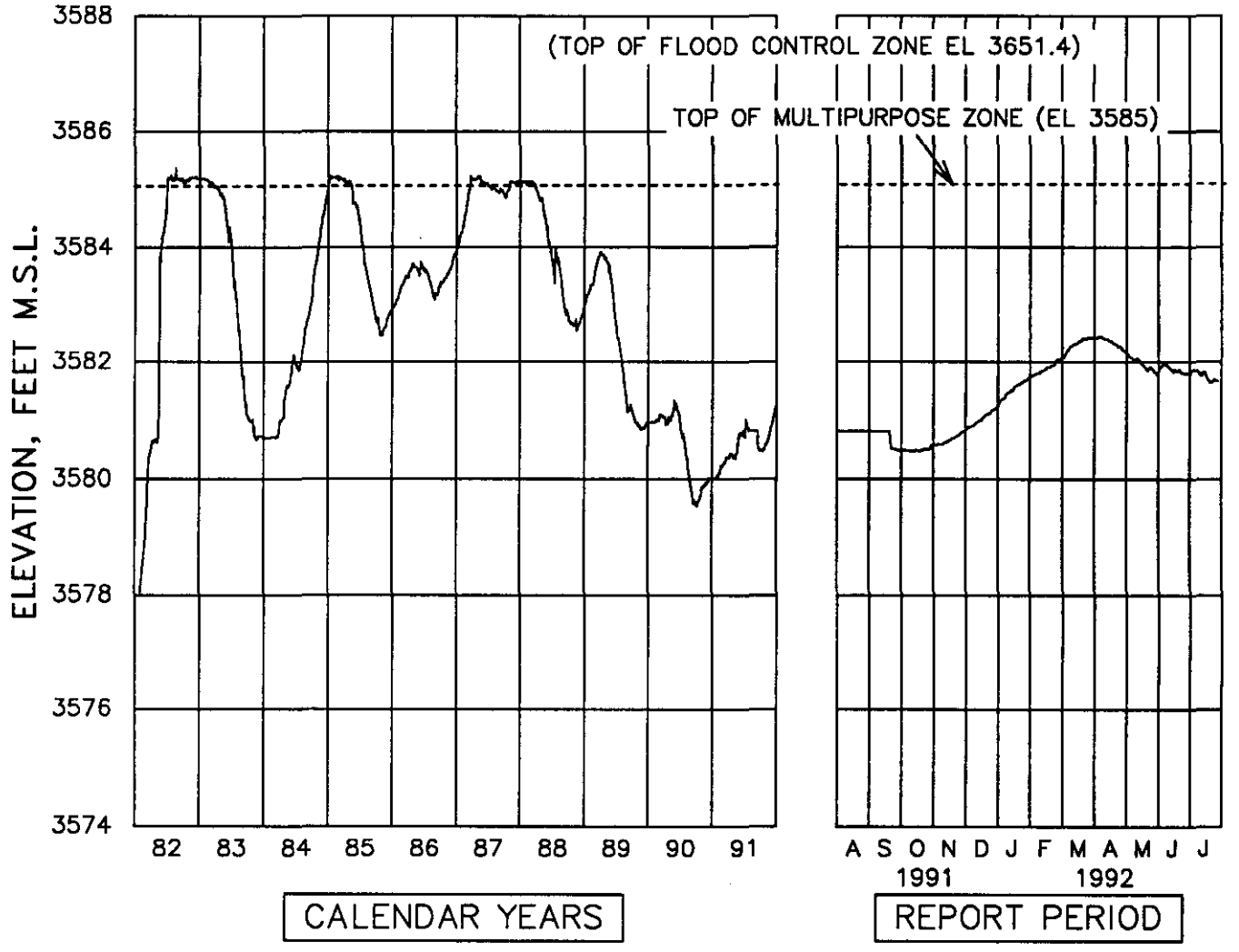
	Pool-Date
Lowest	3576.6 Oct 22 77
2nd	3576.8 Sep 14-Oct 02 81
	Sep 21-22 77

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
352, 63% of normal	263, 56% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
2.2, May 31	.5, Apr 08
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
3582.45, Apr 04	3580.47, Oct 17

COLD BROOK DAM AND LAKE
FALL RIVER BASIN, SOUTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



COTTONWOOD SPRINGS DAM AND LAKE
FALL RIVER BASIN, SOUTH DAKOTA
1991-1992 REGULATION

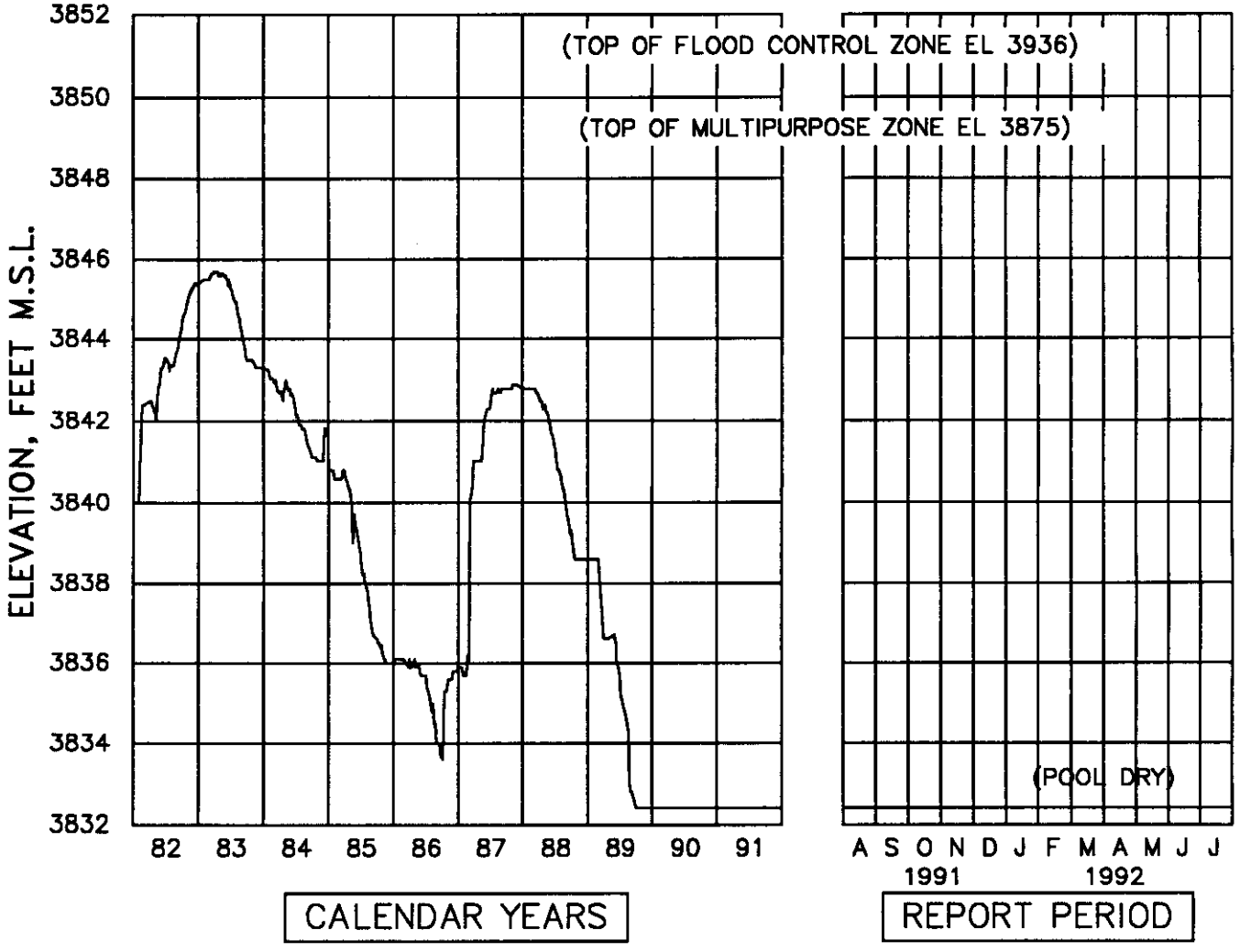
Cottonwood Springs Creek damsite is located on Cottonwood Springs Creek approximately 1/2 mile above its confluence with Hot Brook, a tributary of Fall River. The site is located 4.5 miles west of Hot Springs, Fall River County, South Dakota. The purpose for the project is to provide flood protection for Hot Springs, South Dakota and along the Fall River. No water accumulated during the report period. Inflow was negligible and outflow was zero for the period. No flood control was achieved.

Maximums of Record:

	Pool Date	Daily Inflow-Date	Daily Outflow-Date
Highest	3847.9 Jun 09 79	-	-
2nd	3845.7 Mar-Apr 83	-	-

COTTONWOOD SPRINGS DAM AND LAKE
FALL RIVER BASIN, SOUTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.

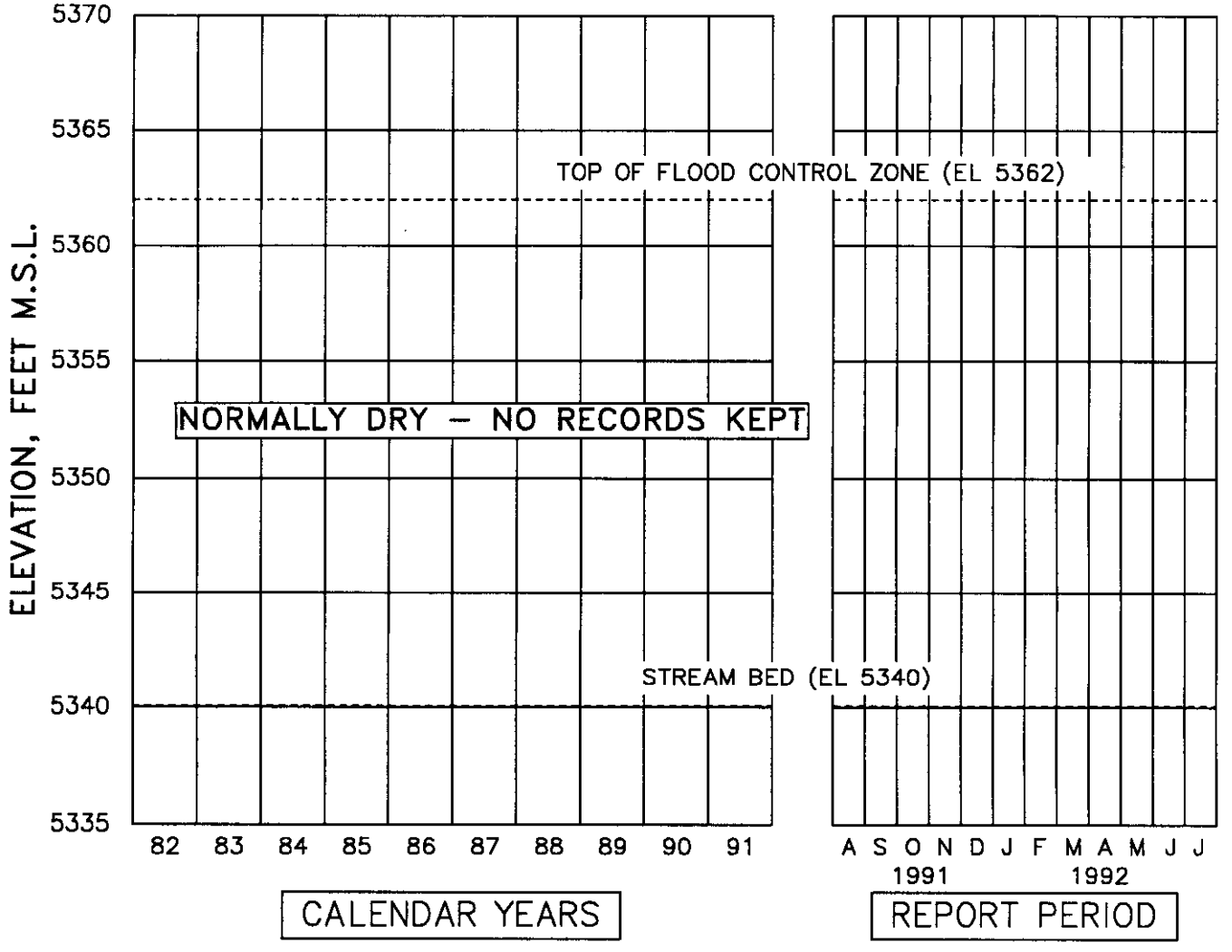


KELLY ROAD DAM
SAND CREEK BASIN, COLORADO
1991-1992 REGULATION

Kelly Road Detention Dam is located on Westerly Creek, a tributary of Sand Creek and the South Platte River and provides flood control for the City of Aurora. It is located entirely within the boundaries of Lowry Air Force Base. The project's sole purpose is flood control and was not designed to permanently store water. Water is automatically impounded by the project and released through a ground level 24-inch CMP conduit or high overflow inlet. A gate on the 24-inch conduit is kept in the open position. The intended closure of the gate is to contain oil or other spills within the air base. The City of Aurora is responsible for obtaining pool gage readings during flood periods and general observation of project operation.

KELLY ROAD DAM
SAND CREEK BASIN, COLORADO
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



WESTERLY CREEK DAM
SAND CREEK BASIN, COLORADO
1991-1992 REGULATION

The Westerly Creek Dam is located approximately 0.8 miles upstream from the Kelly Road Dam on the southern edge of Lowry Air Force Base. Construction of Westerly Creek Dam was completed in July 1991. Both the dam and the detention area are located within the confines of the Lowry Air Force Base and were constructed for the purpose of flood control. The reservoir is generally dry and no permanent storage is provided. The reservoir is discharged by an orifice - controlled outlet structure and overflow spillway. The capacity of the outlet works is 98 cfs at a pool capacity elevation of 5,431.4 feet MSL. Discharge from the outlet works is governed by the capacity of the existing 48-inch RCP storm sewer running into the Kelly Road pool. The sluice gate is intended to remain open unless overtopping of the Kelly Road Dam is imminent or the downstream storm sever capacity is exceeded due to inflows from the downstream drainage area. At this time the gate would be closed until downstream conditions permit releases from the Westerly Creek pool.

GLENN CUNNINGHAM DAM AND LAKE
PAPILLION CREEK BASIN - NO. 11, NEBRASKA
1991-1992 REGULATION

Heavy rainfall kept the pool level in the flood control zone in August, but declined below that level around the end of August. The pool level stayed below the flood control zone until November for a brief period, re-entered it in January and stayed until the end of the reporting period. Inflow in July was 183 percent of average due to heavy rainfall and runoff. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	345 cfs Jun 15 80	152 cfs Jun 18 84
2nd	344 cfs Mar 02 79	116 cfs Jun 16 80
3rd	301 cfs Jun 16 84	87 cfs Mar 04 79

	Pool-Date
Highest	1124.4 Jun 17 84
2nd	1123.7 Jun 15 80
3rd	1123.2 Mar 03 79

Minimums of Record (since initial fill):

	Pool-Date
Lowest	1119.5 Nov 15 89
2nd	1120.2 Oct 30 90

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
4287, 73% of normal	5831, 78% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
81, Jul 12	26, Apr 25
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1121.74, Apr 25, Jul 13	1120.33, Dec 6

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)
4287, 73% of normal

Total Outflow (AF)
5831, 78% of normal

Peak Daily Inflow (CFS)
81, Jul 12

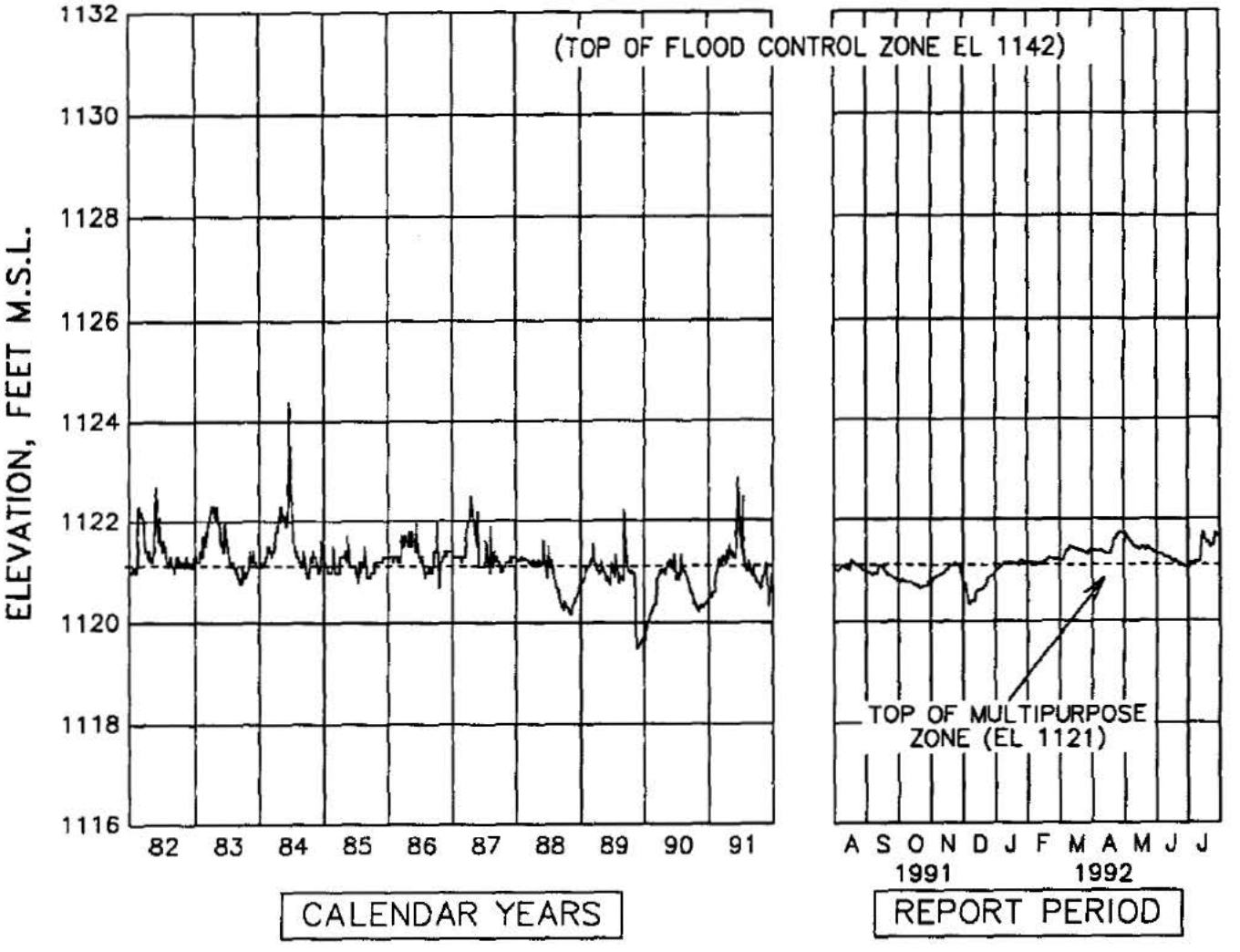
Peak Daily Outflow (CFS)
26, Apr 25

Peak Pool Elevation (Ft. MSL)
1121.74, Apr 25, Jul 13

Minimum Pool Elevation (Ft. MSL)
1120.33, Dec 6

GLENN CUNNINGHAM DAM AND LAKE
PAPILLION CREEK BASIN – NO. 11, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



STANDING BEAR DAM AND LAKE
PAPILLION CREEK BASIN - NO. 16, NEBRASKA
1991-1992 REGULATION

The pool level during the reporting period never exceeded above the flood control zone due to a lack of precipitation and runoff during the report period. The pool level fluctuated significantly in July due to heavy precipitation. Inflow during July was 268 percent of average. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	266 cfs Jun 14 84	65 cfs Jun 16-17 84
2nd	235 cfs Aug 09 87	57 cfs Aug 09 87
3rd	203 cfs Jun 14 91	52 cfs May 22 82

	Pool-Date
Highest	1107.8 Jan 16 84
2nd	1107.1 Aug 08 87
3rd	1106.8 May 21 82

Minimums of Record (since initial fill):

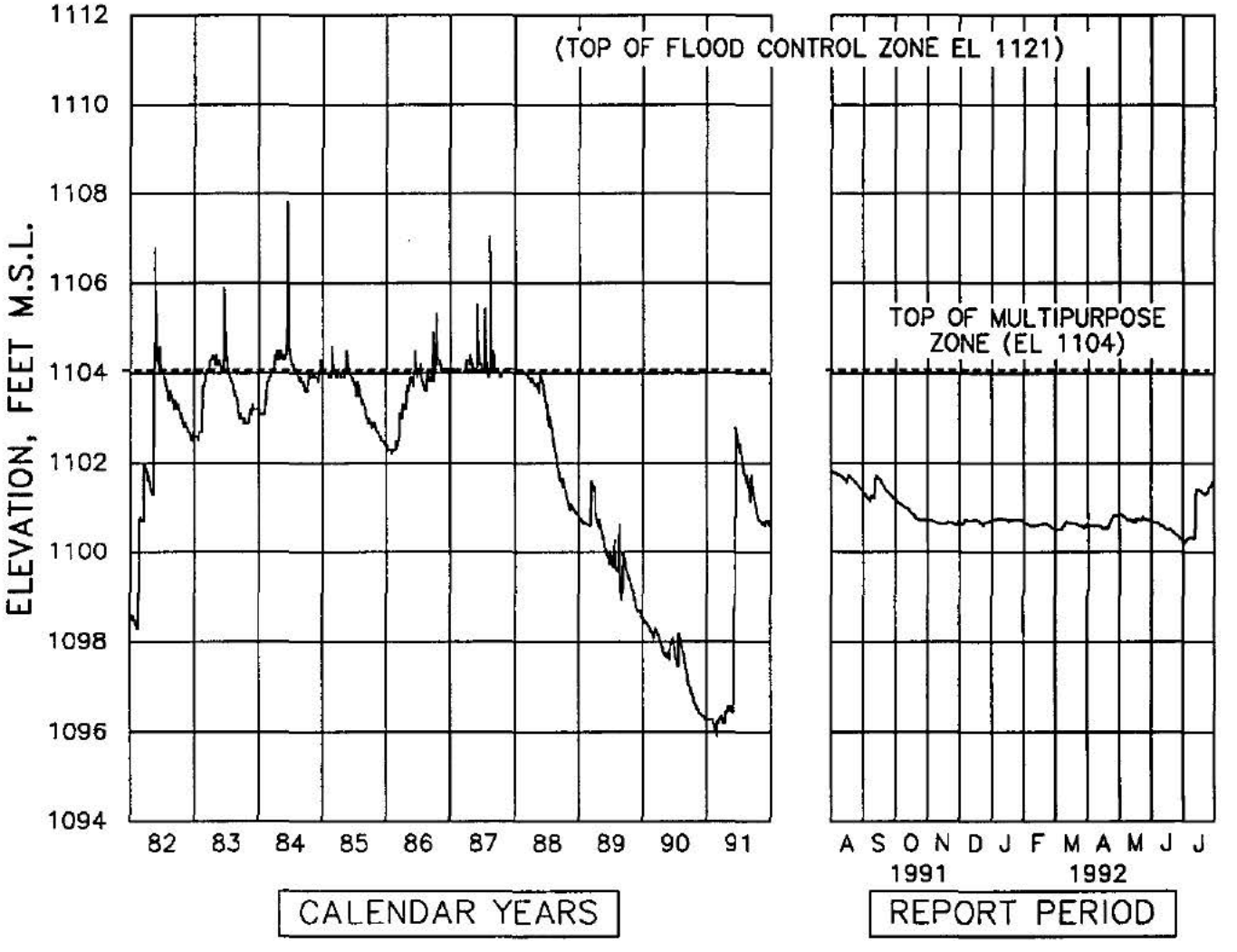
	Pool-Date
Lowest	1095.9 Feb 28 91
2nd	1097.6 May 22 90

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
397, 36% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
31, Jul 12	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1101.82, Aug 01	1100.25, Jun 30

STANDING BEAR DAM AND LAKE
PAPILLION CREEK BASIN – NO. 16, NEBRASKA
1991–1992 REGULALTION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



ZORINSKI DAM AND LAKE
PAPILLION CREEK BASIN - NO. 18, NEBRASKA
1991-1992 REGULATION

The pool level during the reporting period rose in the flood control zone for the first time since closure of the low level gate in December 7, 1989. This rise was due to heavy precipitation and runoff during the months of April and July. Inflows to the project during April and July were 200 percent and 176 percent of average respectively. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	181 cfs Jul 12 92	32 cfs Jul 13 92

	Pool-Date
Highest	1111.31 Jul 12 92

Minimums of Record (since initial fill):

	Pool-Date
Lowest	1109.81 Jun 30 92
2nd	1108.53 Nov 09 91

Report Period: (August 1, 1991 through July 31, 1992)

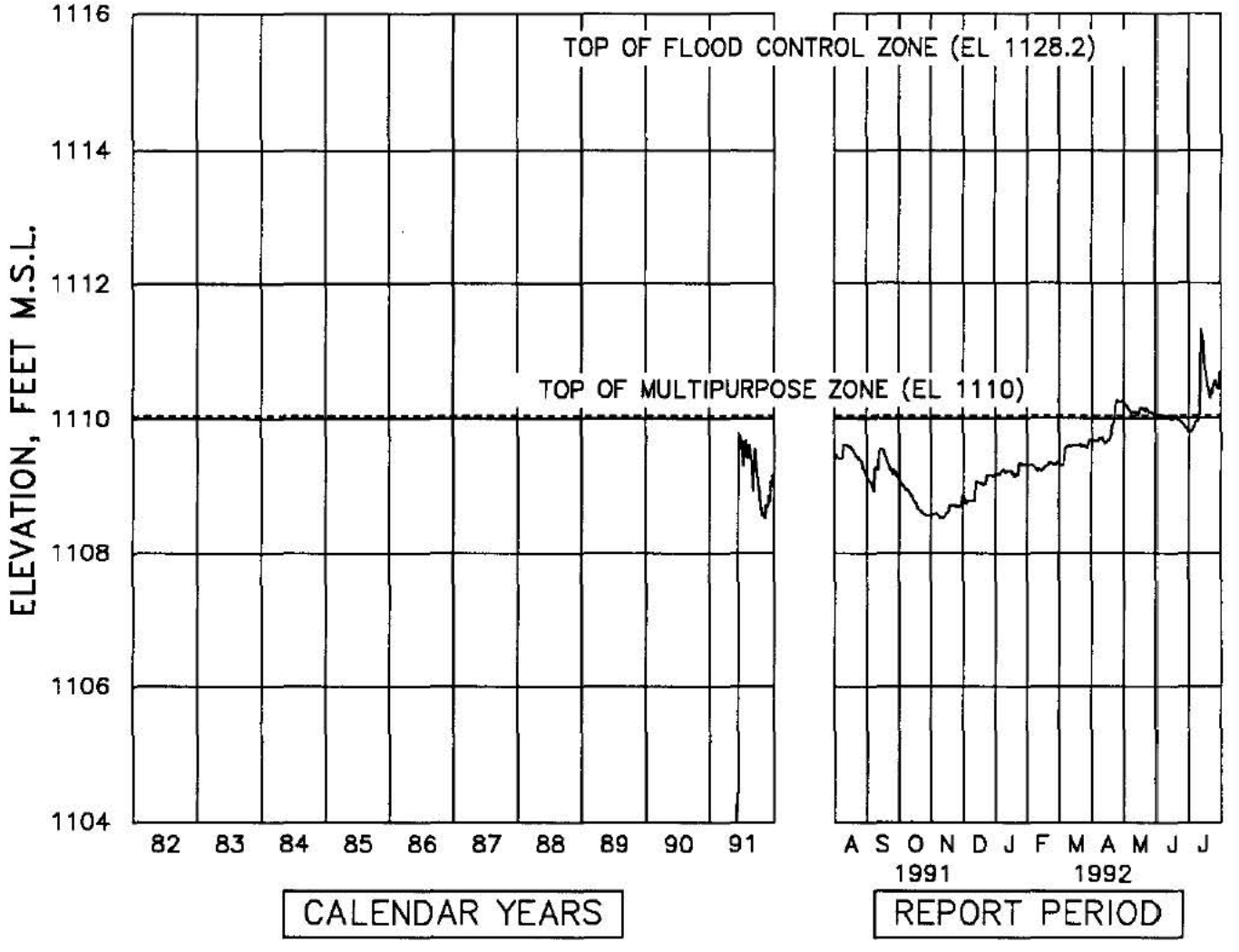
Total Inflow (AF)	**Total Outflow (AF)**
1815, 96% of normal	589, 200% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
181, Jul 12	32, Jul 13
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1111.31, Jul 12	1108.53 Nov 09

ZORINSKI DAM AND LAKE

PAPILLION CREEK BASIN – NO. 18, NEBRASKA

1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



WEHRSPAN DAM AND LAKE
PAPILLION CREEK BASIN - NO. 20, NEBRASKA
1991-1992 REGULATION

The pool level at the beginning the reporting period declined until November when it started to level off. A slight rise occurred in the pool level in April and July due to rainfall and minor runoff. Precipitation of 3.20 inches in April and 7.53 inches during July had inflows of 160 percent and 211 percent of average respectively. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	515 cfs Aug 25 87	77 cfs Aug 26 87
2nd	341 cfs Jun 14 91	
3rd	285 cfs Oct 11 86	28 cfs Jun 09 87
	May 26 87	22 cfs Sep 01 87

	Pool-Date
Highest	1099.5 Aug 25 87
2nd	1097.14 Jun 14 91
3rd	1096.7 May 27 87

Minimums of Record (since initial fill):

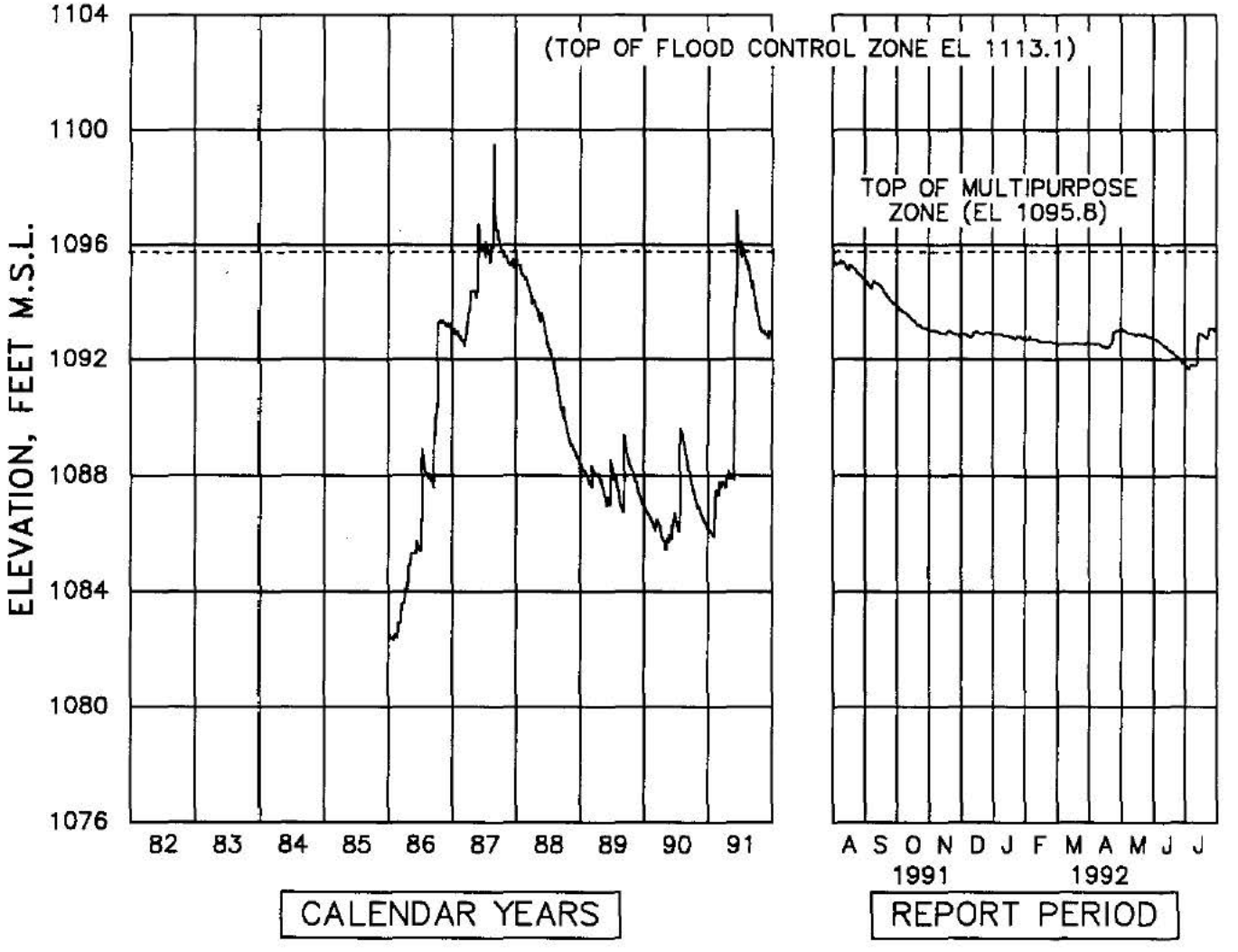
	Pool-Date
Lowest	1085.4 May 02 90
2nd	1085.9 Feb 02 91

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
655, 55% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
68, Jul 12	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1095.47, Aug 01	1091.78, Jun 30

WEHRSPANN DAM AND LAKE
PAPILLION CREEK BASIN – 20, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



PIPESTEM DAM AND LAKE
PIPESTEM CREEK, JAMES RIVER BASIN, NORTH DAKOTA
1991-1992 REGULATION

Releases out of Pipestem began March 6, 1992 when the pool elevation rose above the multipurpose pool (1442.40 feet above MSL). Discharges continued until May 28, 1992 when the pool elevation fell to 1440.50 feet above MSL. No other discharges were made during the reporting period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	3,380 cfs Apr 20 75	310 cfs Oct 22-26, 31 Nov 01, 75
2nd	3,000 cfs Apr 18 79	250 cfs April 10-12 76
3rd	1,945 cfs Mar 05 83	200 cfs Apr 26-29 79 Aug 30-Nov 12 79 Apr 06-09 84 Apr 07-15 88

	Pool-Date
Highest	1468.35 May 10 79
2nd	1466.28 Apr 15 87
3rd	1466.06 Jul 17 75

Minimums of Record (since initial fill):

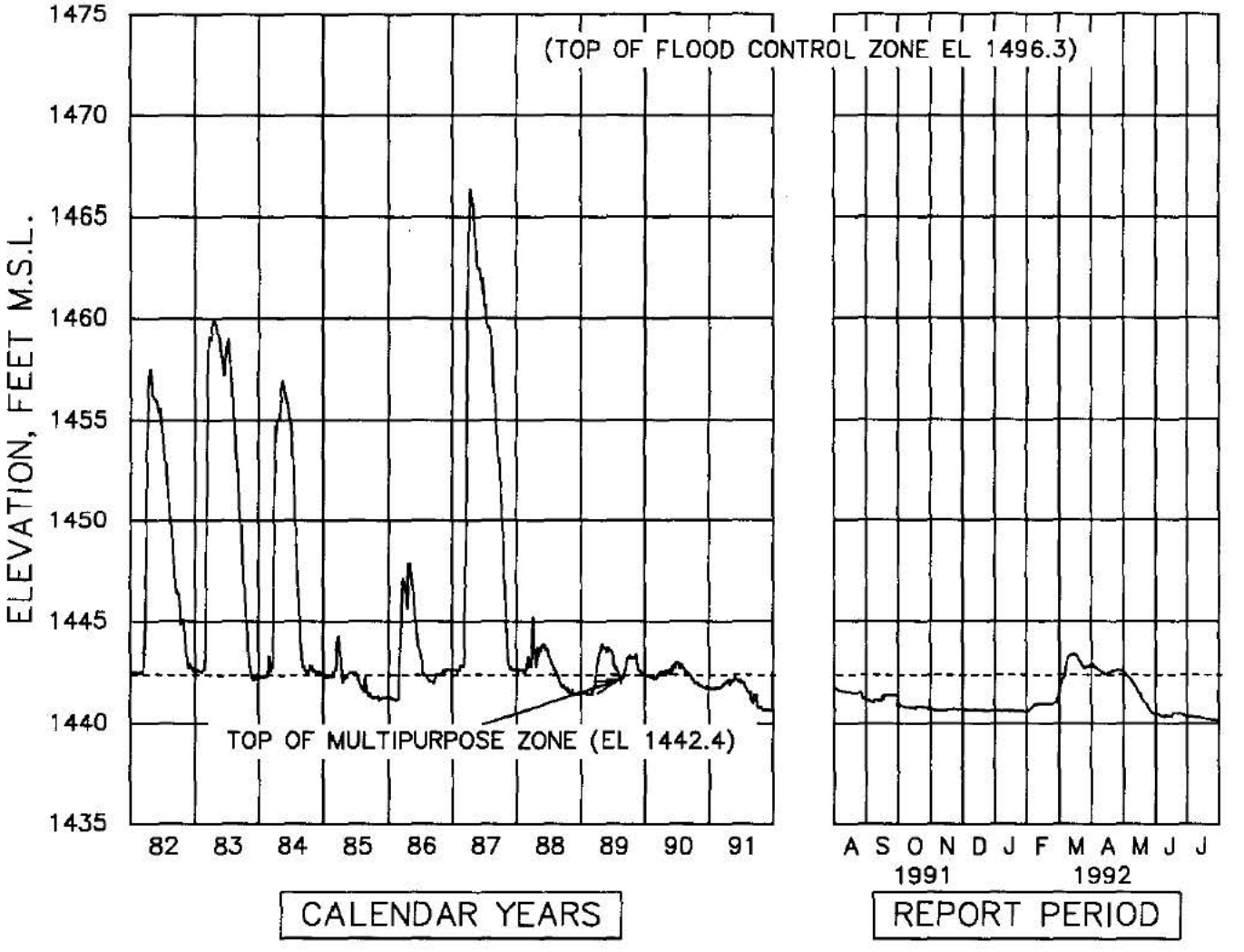
	Pool-Date
Lowest	1439.97 Jan 01 77
2nd	1440.11 Jul 31 92
3rd	1440.50 Feb 09-10 75

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
7747, 31% of normal	5882
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
190, Mar 06	117, Mar 17
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1443.43, Mar 13	1440.11, Jul 31

PIPESTEM DAM AND LAKE
PIPESTEM CREEK, JAMES RIVER BASIN, NORTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



OLIVE CREEK DAM AND LAKE
SALT CREEK BASIN - NO. 2, NEBRASKA
1991-1992 REGULATION

Below normal precipitation and runoff kept the pool level under the flood storage zone throughout the reporting period. The pool level started the reporting period declining until November when small rises occurred through July and a sharp rise was caused due to heavy rainfall at the end of July. Precipitation of 8.42 inches at the damsite for the month of July produced inflows of 225 percent of average. New minimums of record were established during the report period. No flood control was achieved during the report period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	764 cfs Jun 12 84	176 cfs Oct 12 73
2nd	749 cfs Oct 10 73	171 cfs Jun 13 84
3rd	730 cfs Oct 11 86	145 cfs Oct 12 87

	Pool-Date
Highest	1342.6 Oct 11 73
2nd	1342.6 Jun 12 84
3rd	1341.3 Oct 11 86

Minimums of Record (since initial fill):

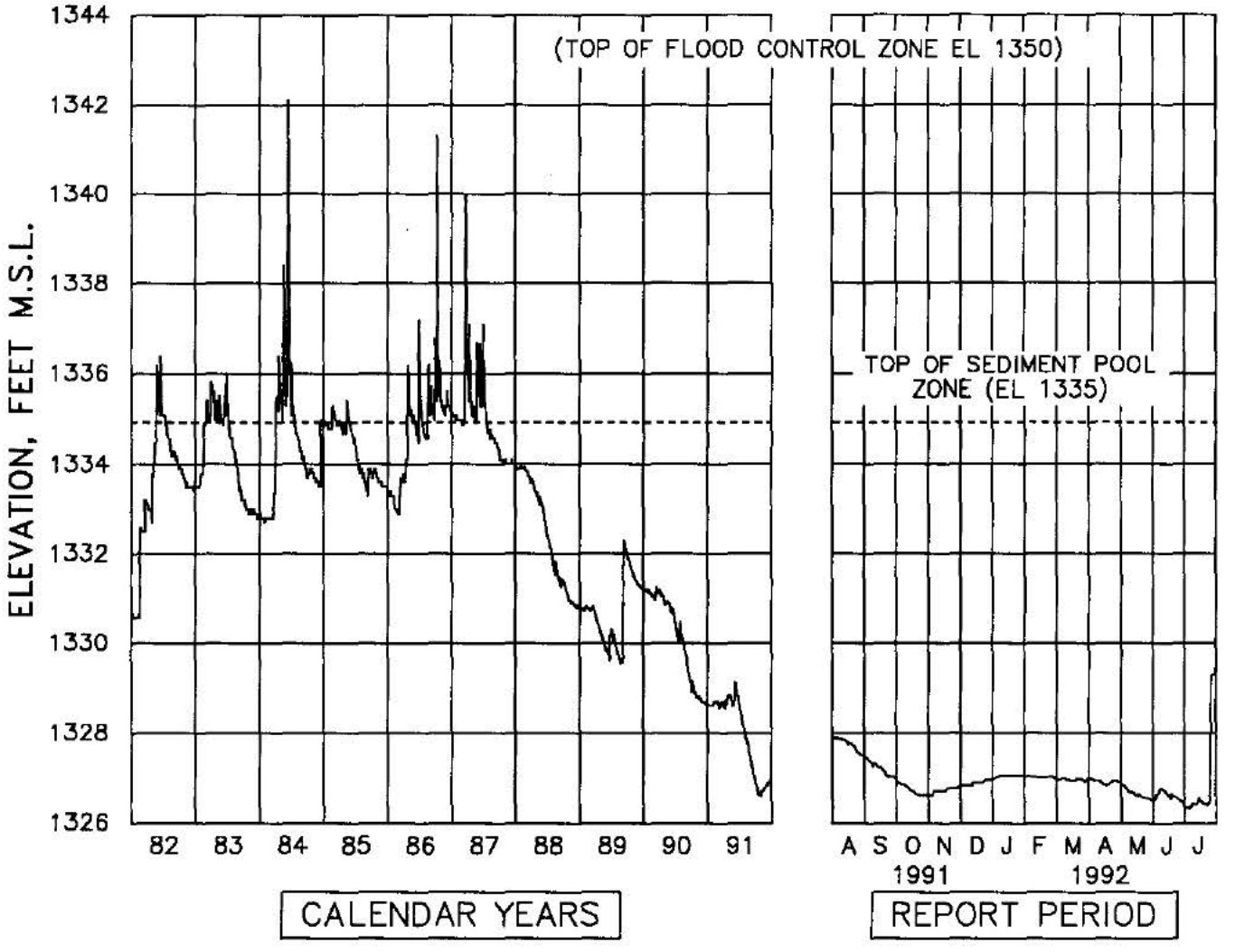
	Pool-Date
Lowest	1326.63 Oct 28 91
2nd	1326.31 Jul 04 92

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
477, 24% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
123, Jul 25	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1329.68, Jul 30	1326.31, Jul 04

OLIVE CREEK DAM AND LAKE
SALT CREEK BASIN – NO. 2, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



BLUESTEM DAM AND LAKE
SALT CREEK BASIN - NO. 4, NEBRASKA
1991-1992 REGULATION

The pool level started the reporting period declining. In October minor rises caused the pool level to fluctuate moderately until June and July when heavy rainfall during those months caused the pool level to reach and enter the flood control zone in July. Precipitation of 3.68 inches in June and 10.59 inches during July caused inflows of 25 percent and 768 percent of average respectively. A new lowest of record was set during the reporting period. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	1,477 cfs Oct 10 73	342 cfs Oct 12 73
2nd	911 cfs Oct 11 86	198 cfs Jun 13 84
3rd	908 cfs Jun 13 84	139 cfs Oct 12 86

	Pool-Date
Highest	1316.5 Oct 11 73
2nd	1314.5 Jun 13 84
3rd	1312.5 Oct 11 86

Minimums of Record (since initial fill):

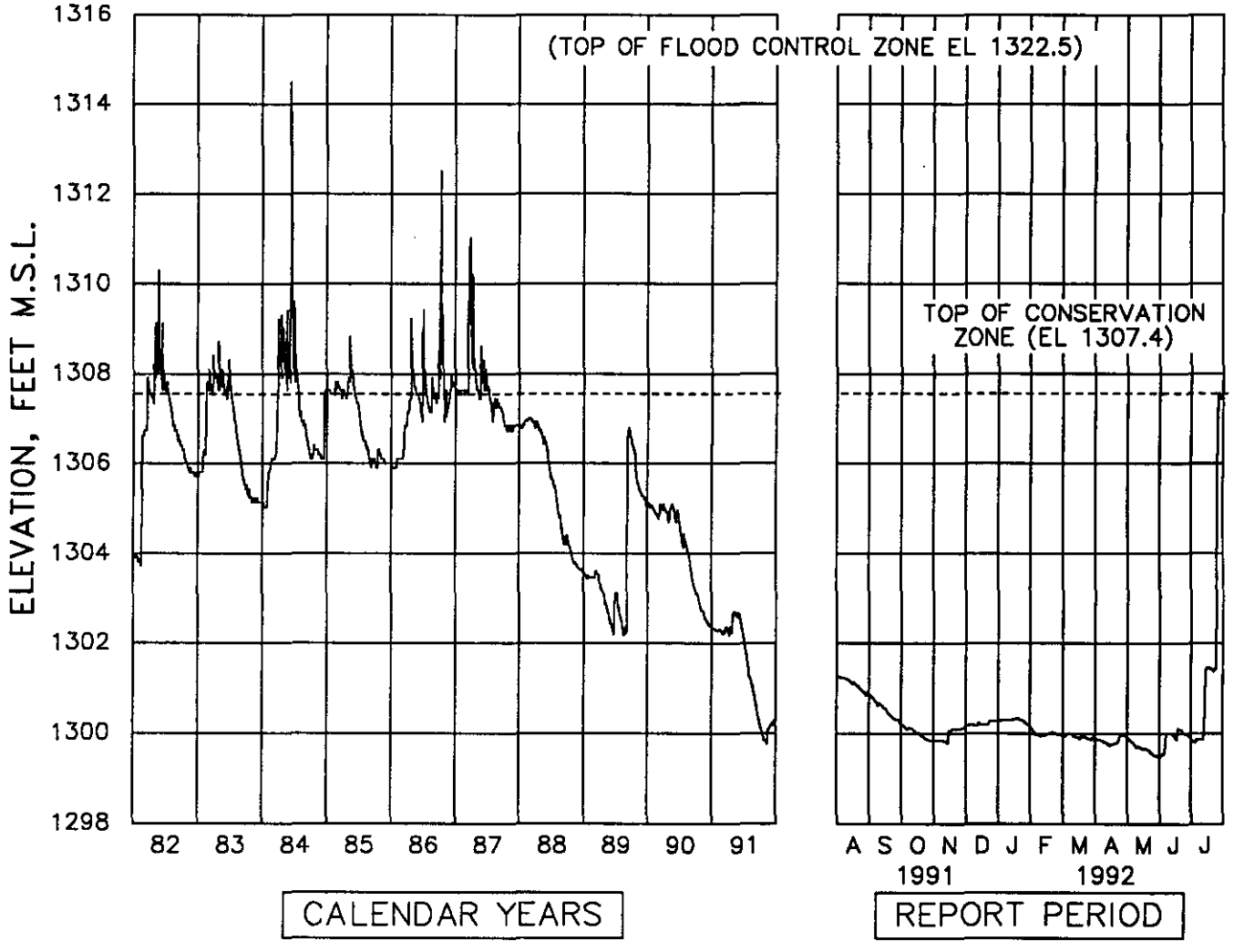
	Pool-Date
Lowest	1299.46 May 31 92
2nd	1299.77 Nov 13 91

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
2509, 65% of normal	81, 3% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
414, Jul 24	23, Jul 31
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1308.21, Jul 30	1299.46, May 31

BLUESTEM DAM AND LAKE
SALT CREEK BASIN – NO. 4, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



WAGON TRAIN DAM AND LAKE
SALT CREEK BASIN - NO. 8, NEBRASKA
1991-1992 REGULATION

The pool level started to decline in August and continue until November when minor rises occurred due to precipitation and runoff. Heavy rainfall of 12.38 inches in July caused the pool level to enter the flood control zone during the end of July. Precipitation produced inflows of 784 percent of average in July. A new lowest pool of record was established during the reporting period. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	1,199 cfs Oct 10 73	329 cfs Oct 12 73
2nd	1,027 cfs Oct 11 86	175 cfs Oct 12 86
3rd	874 cfs Sep 08 89	170 cfs Jun 14 84

	Pool-Date
Highest	1295.4 Oct 11 73
2nd	1293.2 Jun 13 84
	Oct 11 86
3rd	1292.8 Sep 09 89

Minimums of Record (since initial fill):

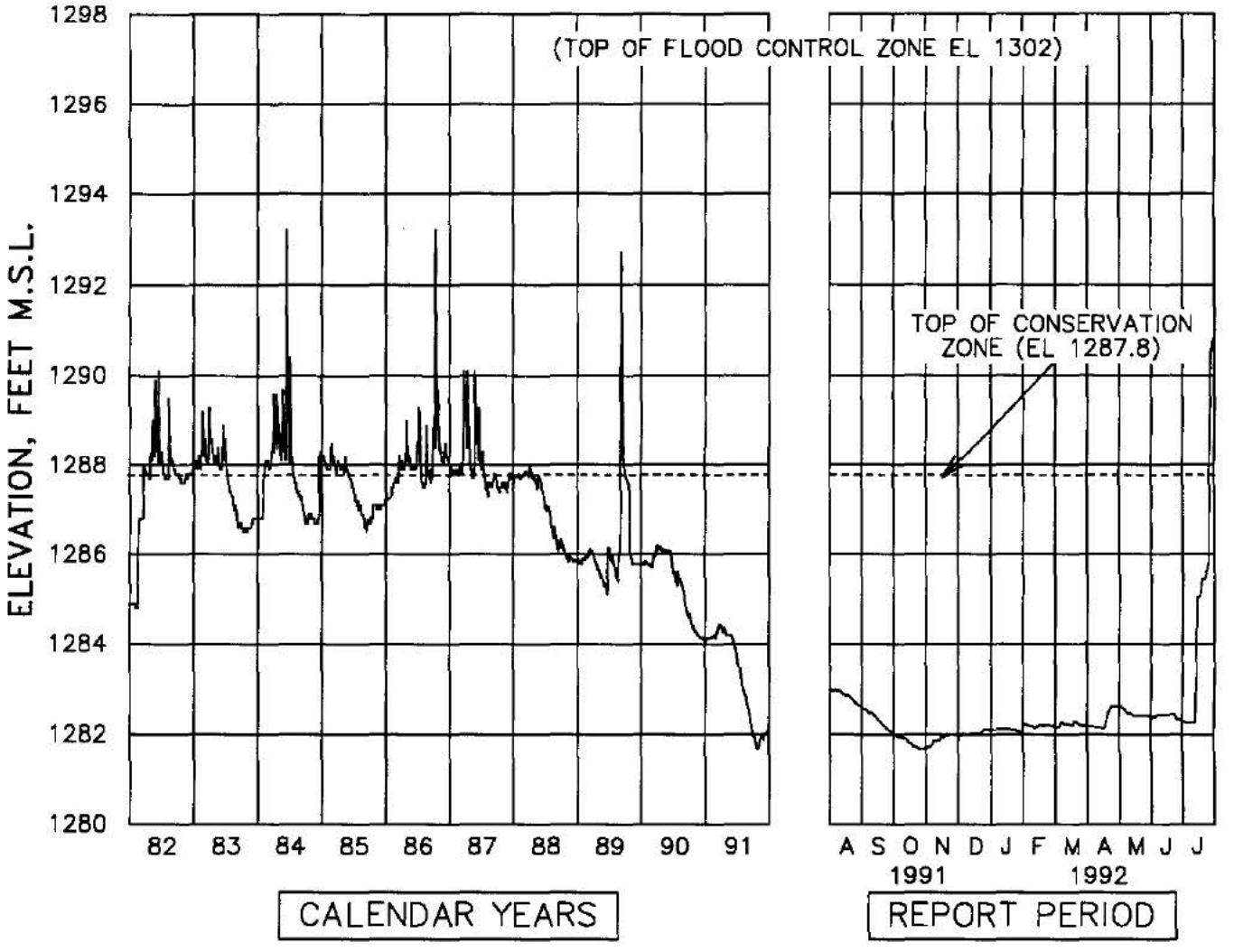
	Pool-Date
Lowest	1281.72 Nov 01 91
2nd	1282.2 Nov 28 75

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
3728, 91% of normal	1077, 36% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
795, Jul 26	102, Jul 29
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1290.80, Jul 28	1281.72, Nov 01

WAGON TRAIN DAM AND LAKE
SALT CREEK BASIN – NO. 8, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



STAGECOACH DAM AND LAKE
SALT CREEK BASIN - NO. 9, NEBRASKA
1991-1992 REGULATION

Due to gage malfunction during January through April, the pool level was estimated for the majority of those months. The pool level began the reporting period declining until November when it slowly began to climb its way into the flood control zone due to some runoff and precipitation. Heavy rainfall in July put the pool level in the flood control zone near the end of the month. Inflows to the project during July were 612 percent of average. A new lowest of record was set during the reporting period. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	958 cfs Oct 10 73	190 cfs Oct 12 73
2nd	829 cfs Oct 11 86	116 cfs Oct 12 86
3rd	482 cfs Jun 12 84	109 cfs Jun 14 84

	Pool-Date
Highest	1279.0 Oct 11 73
2nd	1277.4 Oct 11 86
3rd	1277.1 Jun 13 84

Minimums of Record (since initial fill):

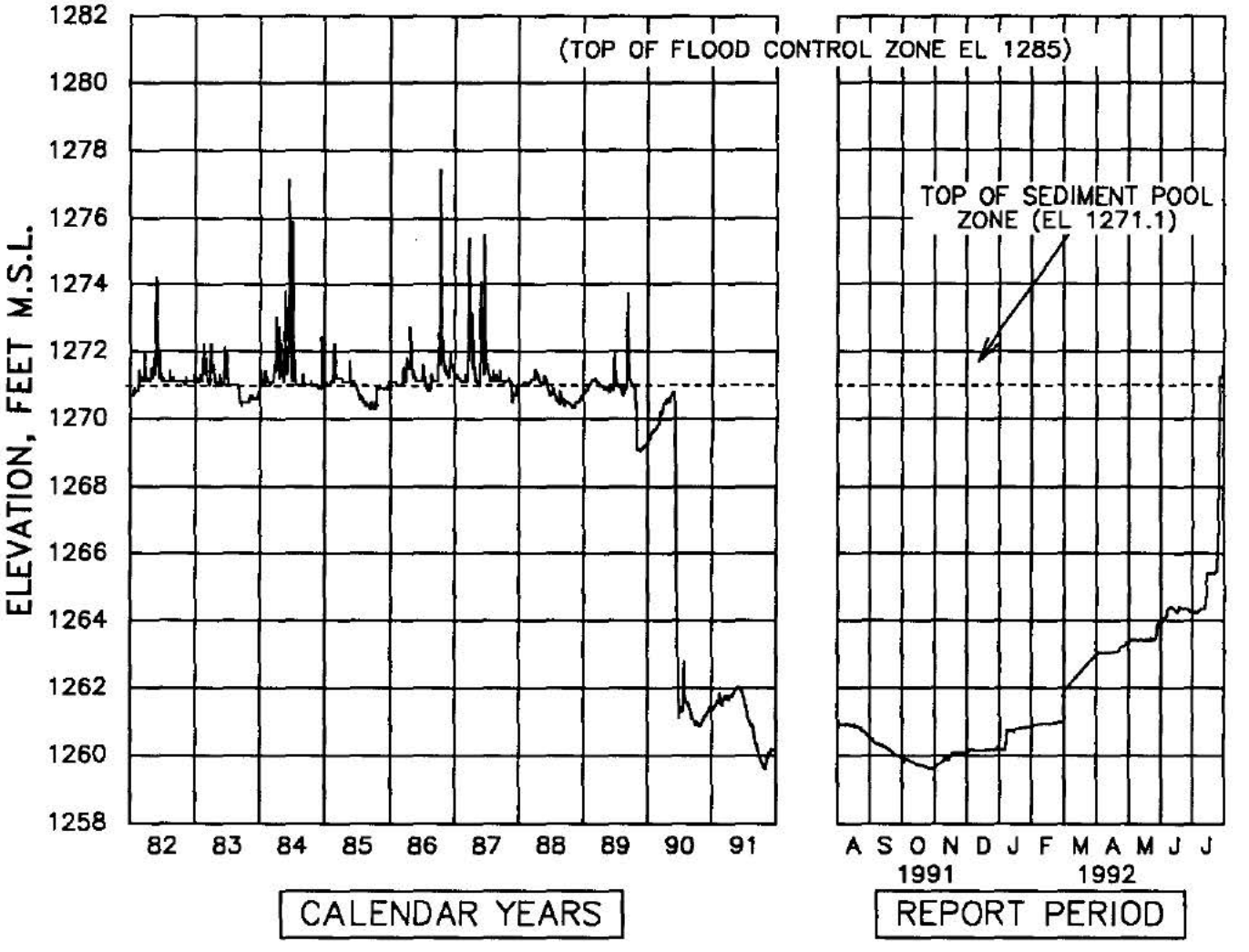
	Pool-Date
Lowest	1259.60 Oct 31 91
2nd	1260.5 Aug 09 76

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
1975, 76% of normal	69, 4% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
258, Jul 26	14, Jul 31
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1271.87, Jul 30	1259.60, Oct 31

STAGECOACH DAM AND LAKE
SALT CREEK BASIN – NO. 9, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



YANKEE HILL DAM AND LAKE
SALT CREEK BASIN - NO. 10, NEBRASKA
1991-1992 REGULATION

The pool level began the reporting period declining until November when slight rises occurred due to rainfall and runoff. The pool level dropped again in February and continued through May. Minor rises resumed in June. Due to heavy rainfall in July, the pool level entered the flood control zone toward the end of the month. Inflows to the project during July were 494 percent of average. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	690 cfs Oct 10 73	145 cfs Oct 12 73
2nd	575 cfs Sep 08 89	114 cfs Jun 14 84
3rd	538 cfs Oct 11 86	100 cfs Mar 25 87

	Pool-Date
Highest	1252.3 Oct 11 73
2nd	1250.7 Jun 13 84
3rd	1250.0 Mar 25 87

Minimums of Record (since initial fill):

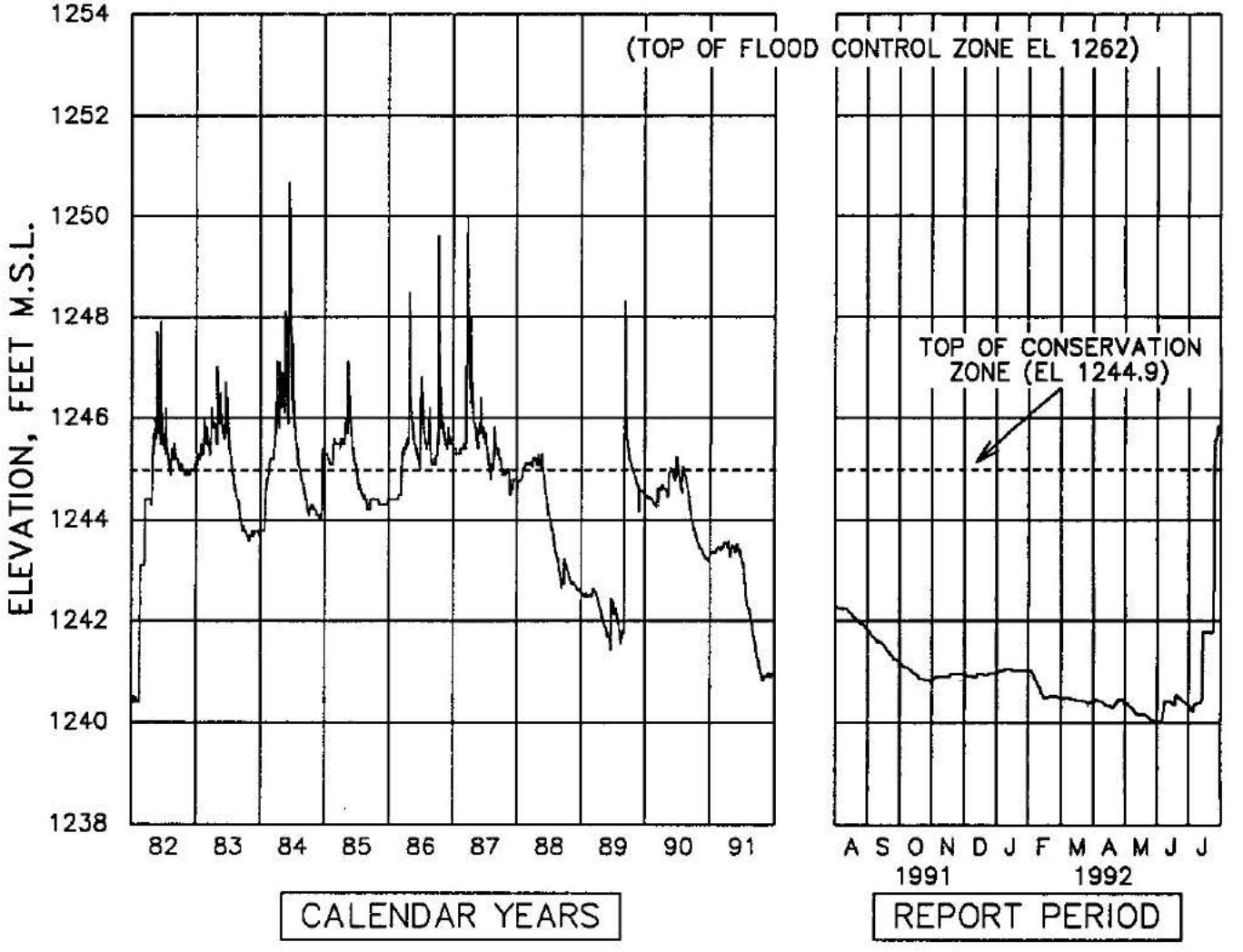
	Pool-Date
Lowest	1238.9 Aug 08 77
2nd	1239.1 Sep 19 81

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
1906, 41% of normal	385, 10% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
307, Jul 24	63, Jul 31
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1247.38, Jul 30	1240.00, May 30, 31

YANKEE HILL DAM AND LAKE
SALT CREEK BASIN – NO. 10, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



CONESTOGA DAM AND LAKE
SALT CREEK BASIN - NO. 12, NEBRASKA
1991-1992 REGULATION

Precipitation and runoff during the reporting period was below normal. The pool level remained below flood control zone throughout the period. The pool level began the reporting period declining. Minor rises occurred during the report period but none so observant as the month of July due to precipitation of 7.87 inches. Inflows to the project during July were 137 percent of average. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	907 cfs Mar 24 87	185 cfs Mar 25 87
2nd	661 cfs Jun 27 83	152 cfs Jun 16 82
3rd	620 cfs Jun 15 82	51 cfs Oct 12 73

	Pool-Date
Highest	1241.1 Mar 24 87
2nd	1239.6 Oct 11 73
3rd	1238.3 Jun 15 82

Minimums of Record (since initial fill):

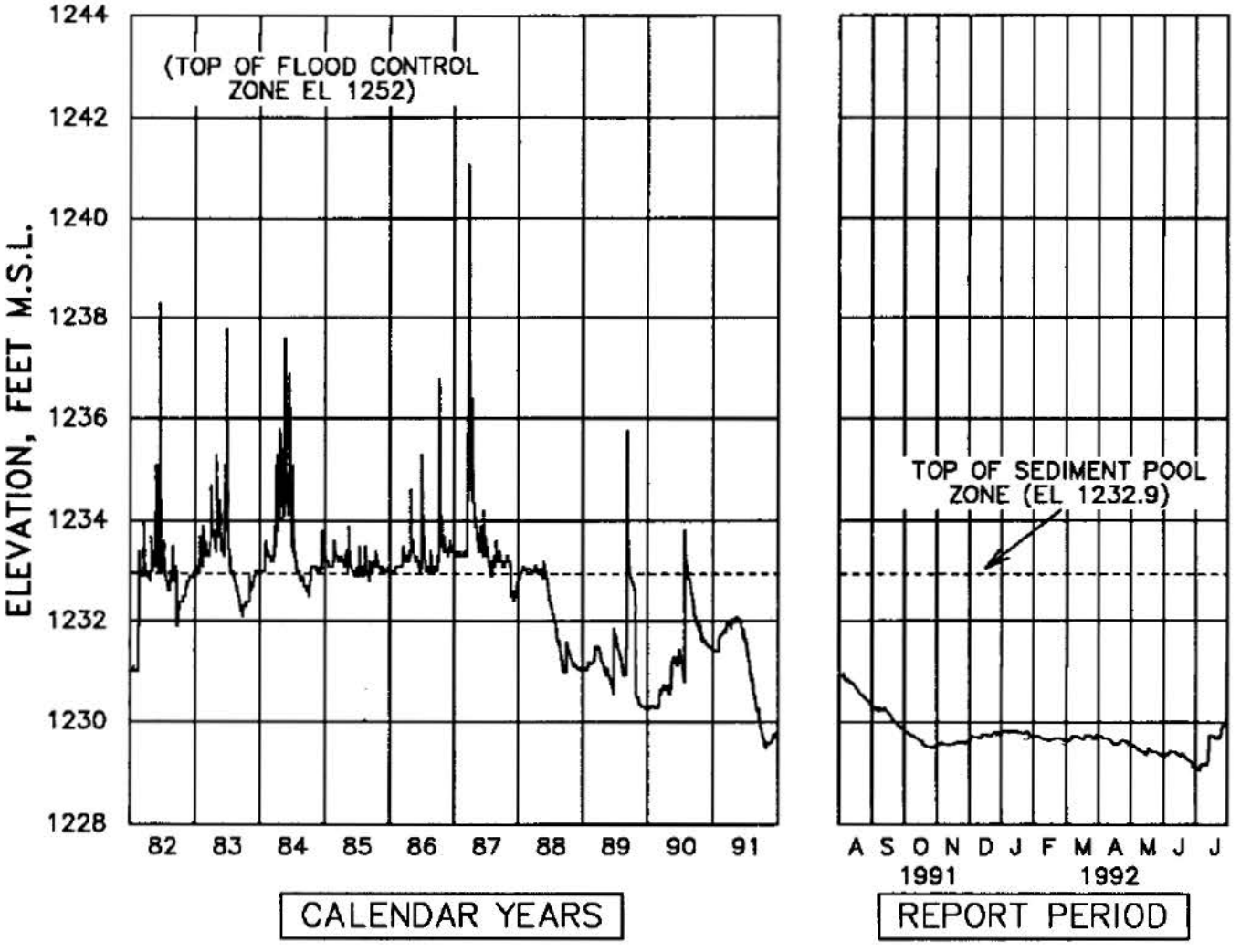
	Pool-Date
Lowest	1228.4 Aug 28 77
2nd	1229.12 Jun 30 92

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
845, 14% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
169, Jul 30	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1231.66, Jul 31	1229.12, Jun 30

CONESTOGA DAM AND LAKE
SALT CREEK BASIN – NO. 12, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



TWIN LAKES DAM AND LAKE
SALT CREEK BASIN - NO. 13, NEBRASKA
1991-1992 REGULATION

Because of below normal precipitation and runoff during the reporting period, the pool level remained under the flood control zone. The pool level reached a new lowest of record during the period. It started the reporting period declining and slight rises occurred in the pool level during the months of November through June. In June and July heavy rainfall of 4.22 inches and 6.75 inches at the damsite caused high rises in the pool level. Inflows during June and July were 48 percent and 253 percent of average respectively. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	539 cfs Mar 23 87	168 cfs Jun 30 83
2nd	507 cfs Jun 28 83	167 cfs Mar 24 87
3rd	476 cfs Jun 12 84	162 cfs May 20 84

	Pool-Date
Highest	1346.9 Jun 29 83
2nd	1346.0 Mar 23 87
3rd	1344.6 May 19 84

Minimums of Record (since initial fill):

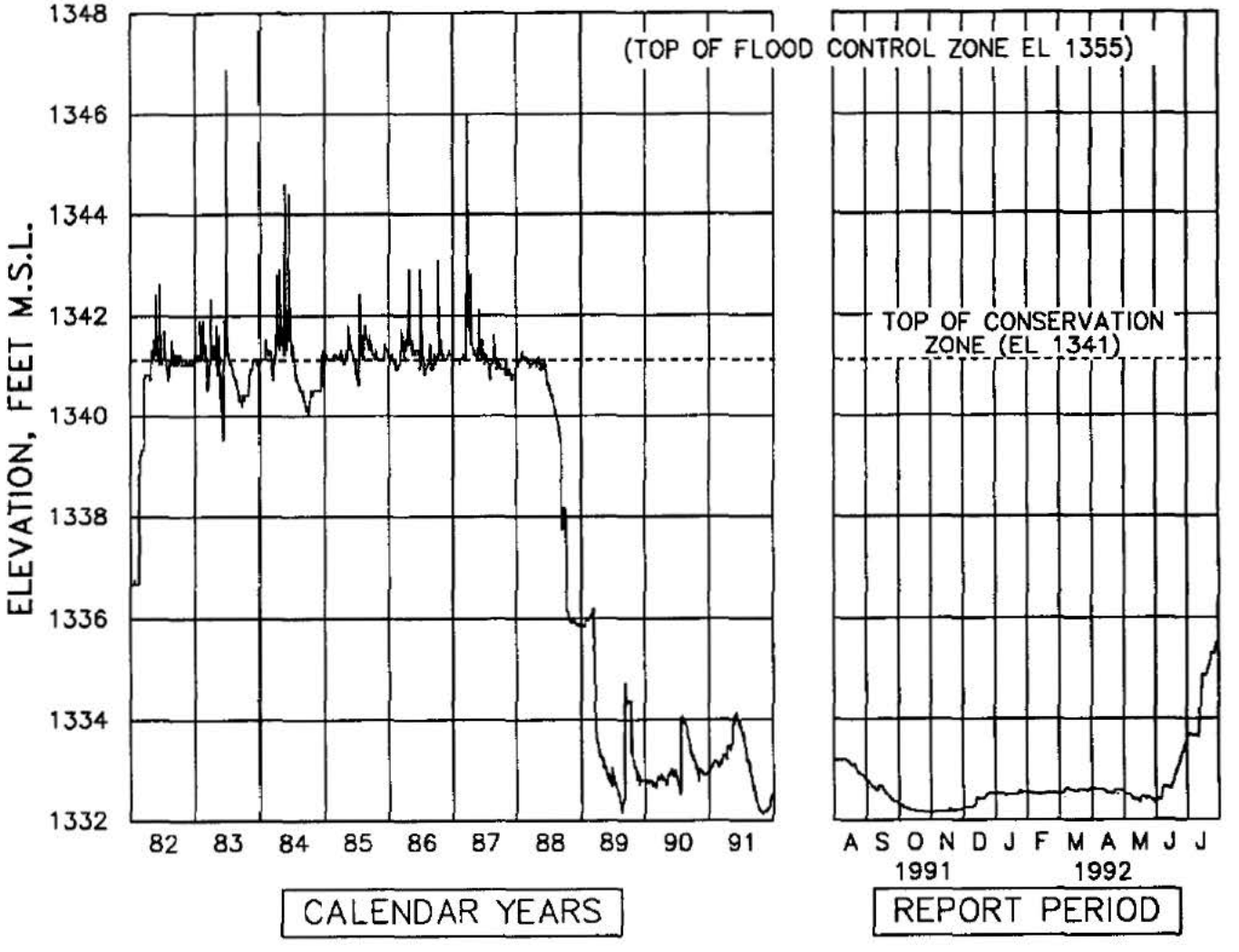
	Pool-Date
Lowest	1332.13 Oct 31 91
2nd	1332.2 Aug 18 89

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
1211, 32% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
148, Jul 30	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1337.20, Jul 31	1332.13, Oct 31

TWIN LAKES DAM AND LAKE
SALT CREEK BASIN – NO. 13, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



PAWNEE DAM AND LAKE
SALT CREEK BASIN - NO. 14, NEBRASKA
1991-1992 REGULATION

The pool level remained below the flood control zone throughout the reporting period due to a lack of precipitation and runoff. The pool level began the reporting period declining, but in November started to rise and continue through the rest of the period. Heavy rainfall in July (5.08 inches) had inflows of 180 percent of average. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	1,381 cfs Mar 24 87	419 cfs Mar 25, 26 87
2nd	1,074 cfs Jul 19 85	311 cfs Jun 13 84
3rd	901 cfs Jul 01 86	294 cfs Jul 01 86

	Pool-Date
Highest	1248.4 Mar 24, 25, 27 87
2nd	1247.1 Jun 12 84
3rd	1246.8 Jul 01 86

Minimums of Record (since initial fill):

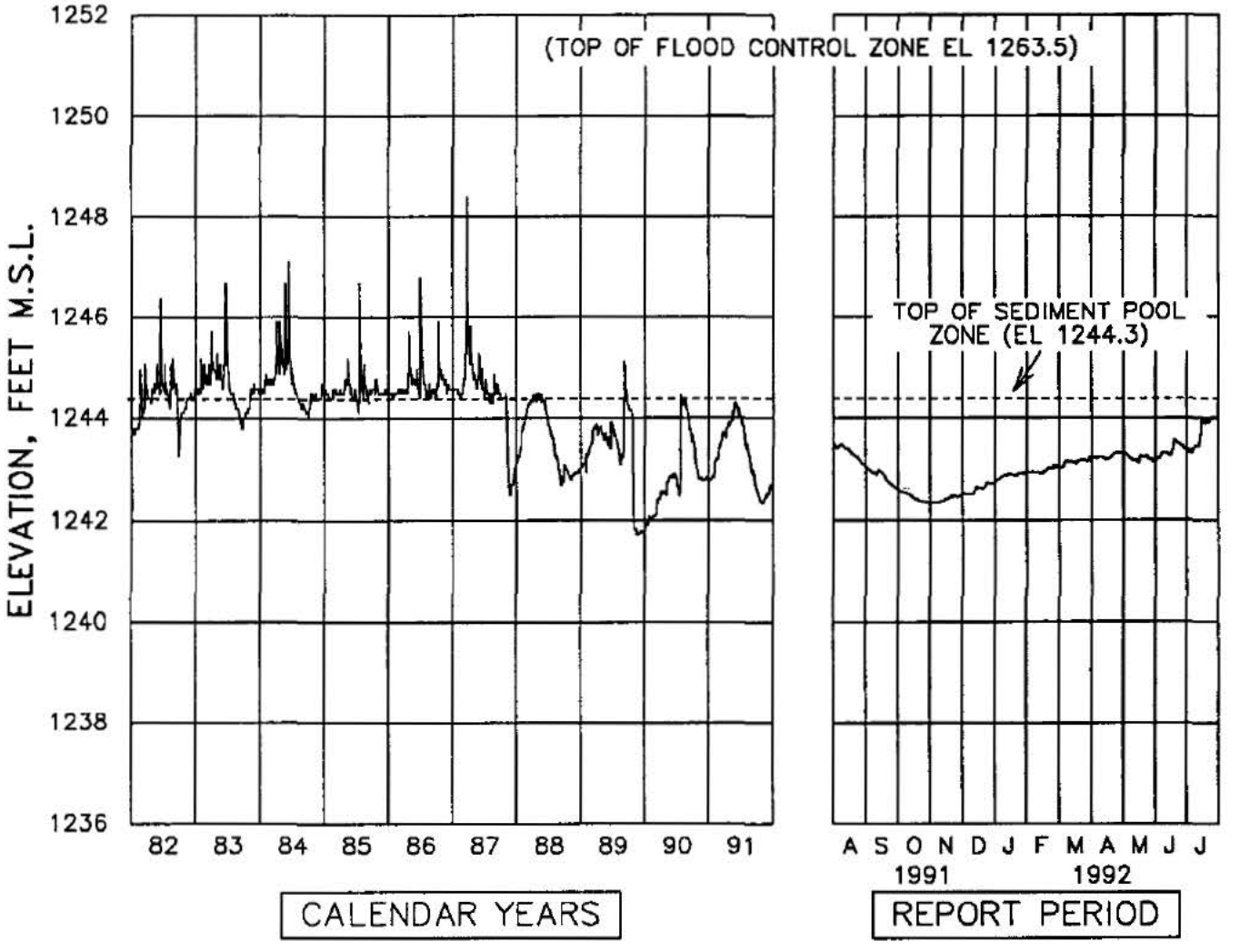
	Pool-Date
Lowest	1240.2 Oct 14 79
2nd	1241.2 Jan 01 77

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
3309, 42% of normal	36, 1% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
248, Jul 30	12, Jul 31
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1244.61, Jul 30	1242.34, Oct 28

PAWNEE DAM AND LAKE
SALT CREEK BASIN – NO. 14, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



ANTELOPE CREEK DAM AND HOLMES PARK LAKE
SALT CREEK BASIN - NO. 17, NEBRASKA
1991-1992 REGULATION

The pool level started to decline during the beginning of the reporting period. At the end of November, the pool level began to climb and continued throughout the period. Due to runoff and precipitation in March, the pool level entered the flood control zone for a brief period and receded below the level until the end of April. The pool level re-entered the flood control zone, fluctuating above and below the level, until the beginning of July and stayed until the end of the reporting period. Heavy rainfall in April through July produced inflows to the project of 43 percent, 73 percent, 153 percent and 508 percent of average respectively. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	567 cfs Sep 08 89	187 cfs Jun 29 83
2nd	401 cfs Jun 27 83	140 cfs Sep 09 89
3rd	381 cfs Jun 27 83	134 cfs May 25 84

	Pool-Date
Highest	1249.1 Sep 08 89
2nd	1248.1 Jun 27 83
3rd	1247.9 Oct 11 86

Minimums of Record (since initial fill):

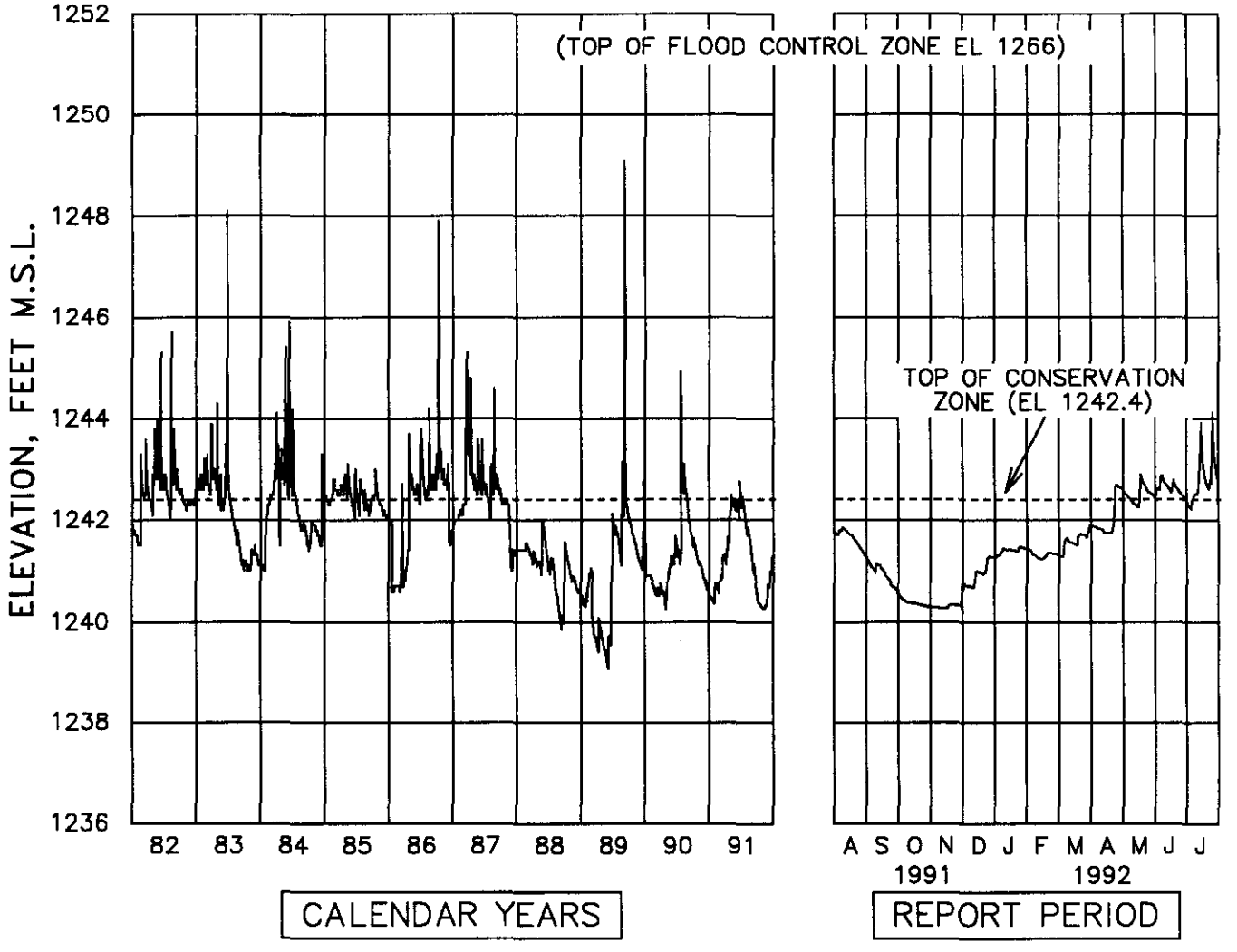
	Pool-Date
Lowest	1232.9 Aug 03 77
2nd	1236.8 Feb 26 76

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
2245, 98% of normal	1652, 96% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
133, Jul 24	61, Jul 25
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1244.11, Jul 24	1240.28, Nov 08

ANTELOPE CREEK DAM AND HOLMES PARK LAKE
SALT CREEK BASIN – NO. 17, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



BRANCHED OAK DAM AND LAKE
SALT CREEK BASIN - NO. 18, NEBRASKA
1991-1992 REGULATION

Precipitation in August during the reporting period kept the pool level in the flood control zone for a brief moment and receded below the level in the middle of August. In November, runoff and precipitation made the pool level rise and fluctuate up until July when heavy rainfall of 7.72 inches at the damsite caused the pool level to re-enter the flood control zone and stay throughout the period. Inflow to the project during July was 99 percent of average. Gated releases were made in August, September and July. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	3,700 cfs Aug 25 87	730 cfs Aug 26 87
2nd	2,435 cfs Mar 23 87	670 cfs Jun 19 83
3rd	1,780 cfs Jun 18 83	667 cfs Mar 24 87

	Pool-Date
Highest	1287.9 Aug 26 87
2nd	1287.7 Jun 18 83 Mar 23 87
3rd	1287.2 Jun 13 84

Minimums of Record (since initial fill):

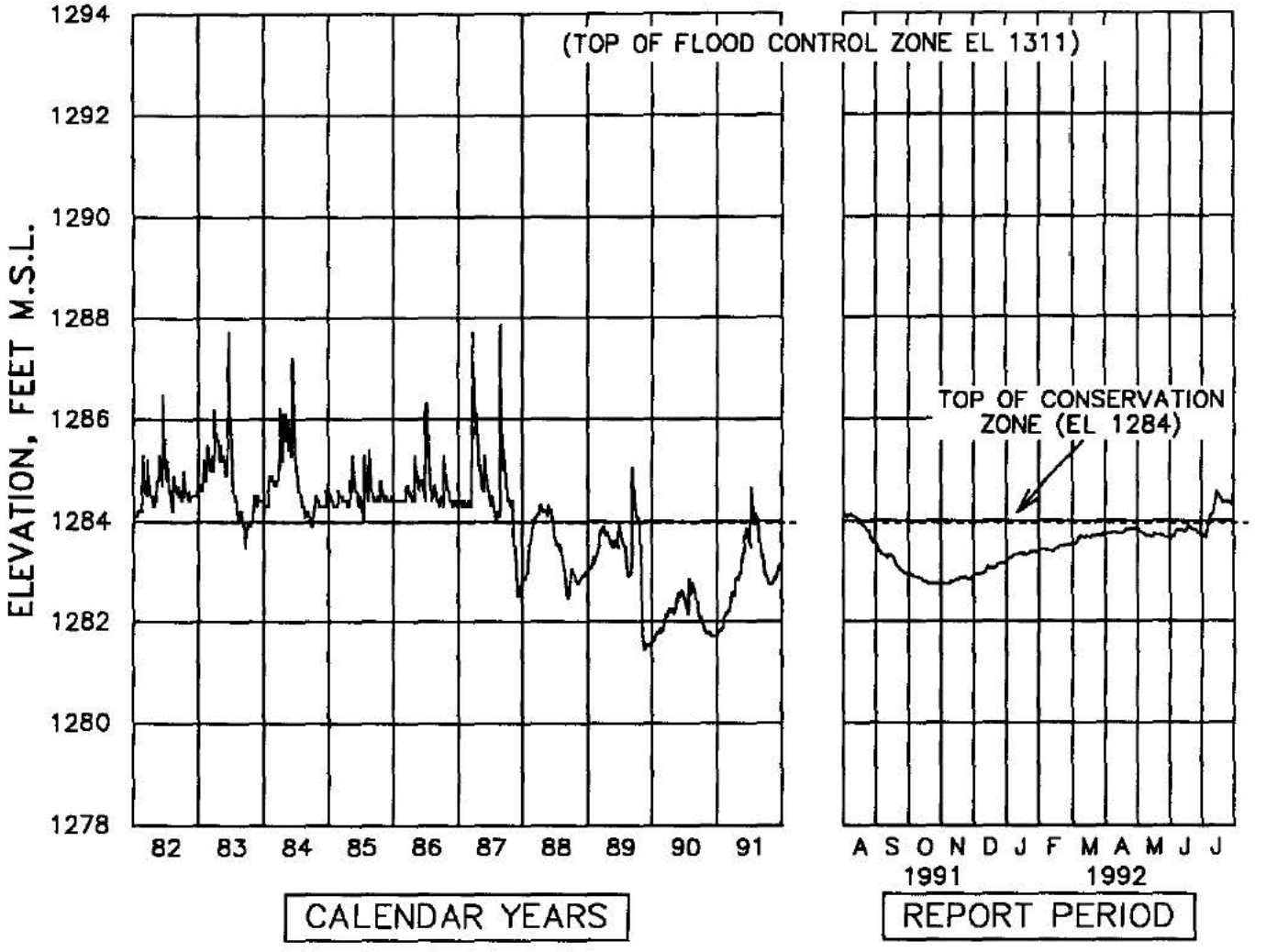
	Pool-Date
Lowest	1280.9 Jan 01 77
2nd	1281.5 Nov 25 89

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
10526, 38% of normal	2371, 11% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
575, Jul 30	87, Jul 31
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1284.88, Jul 31	1282.73, Nov 03

BRANCHED OAK DAM AND LAKE
SALT CREEK BASIN – NO. 18, NEBRASKA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



SNAKE CREEK DAM AND LAKE AUDUBON
LAKE SAKAKAWEA SUBIMPOUNDMENT
MISSOURI RIVER BASIN, NORTH DAKOTA
1991-1992 REGULATION

Lake Audubon, a subimpoundment of Garrison Reservoir, is located 8 miles northeast of Riverdale, North Dakota. The embankment, known as "Snake Creek", has a crest elevation of 1865 ft. MSL. The original planned operating level of 1850 ft. MSL, Lake Audubon would cover 20,600 acres and contains 396,000 AF of water.

The embankment was constructed with the primary purpose of relocating U.S. Highway 83 and the Soo Line Railroad across the Snake Creek Arm of the Garrison Diversion. In addition, during the planning stage it was decided to create a gated subimpoundment for the dual purpose of fish and wildlife enhancement, and the future diversion of water for anticipated irrigation. The pool level has been kept below elevation 1850 because (1) all land surrounding the lake has not been acquired to maintain the 1850 level and (2) that level (head) is not needed to supply water to the revised lower irrigation acreage. Garrison pool levels are limited to less than 15 feet above the Audubon pool for dam safety consideration. Most of the time, however, the Lake Audubon level is higher than the Garrison pool. If the latter condition exists, the Snake Creek pumping plant, operated by the Bureau, is used to transfer water from Garrison Reservoir to Lake Audubon. Gravity flow discharge to or from Lake Audubon is conveyed by a gated conduit 7 feet wide by 10 feet high with invert elevation at 1810 ft. MSL. This gated conduit is normally closed.

Lake Audubon was operated in accordance with the 1987 Letter of Understanding between the Corps, the Bureau of Reclamation, Fish and Wildlife Service, and the North Dakota Game and Fish Department. On October 11, the gate was opened and the pool was lowered from 1846.8 to 1843.7 in response to a request from the USBR. Beginning on April 6, and continuing intermittently through the spring and summer months, water was pumped into Lake Audubon from Lake Sakakawea. The pool was maintained as close to the target pool of 1847.2 as possible.

Maximums of Record: Minimums of Record:

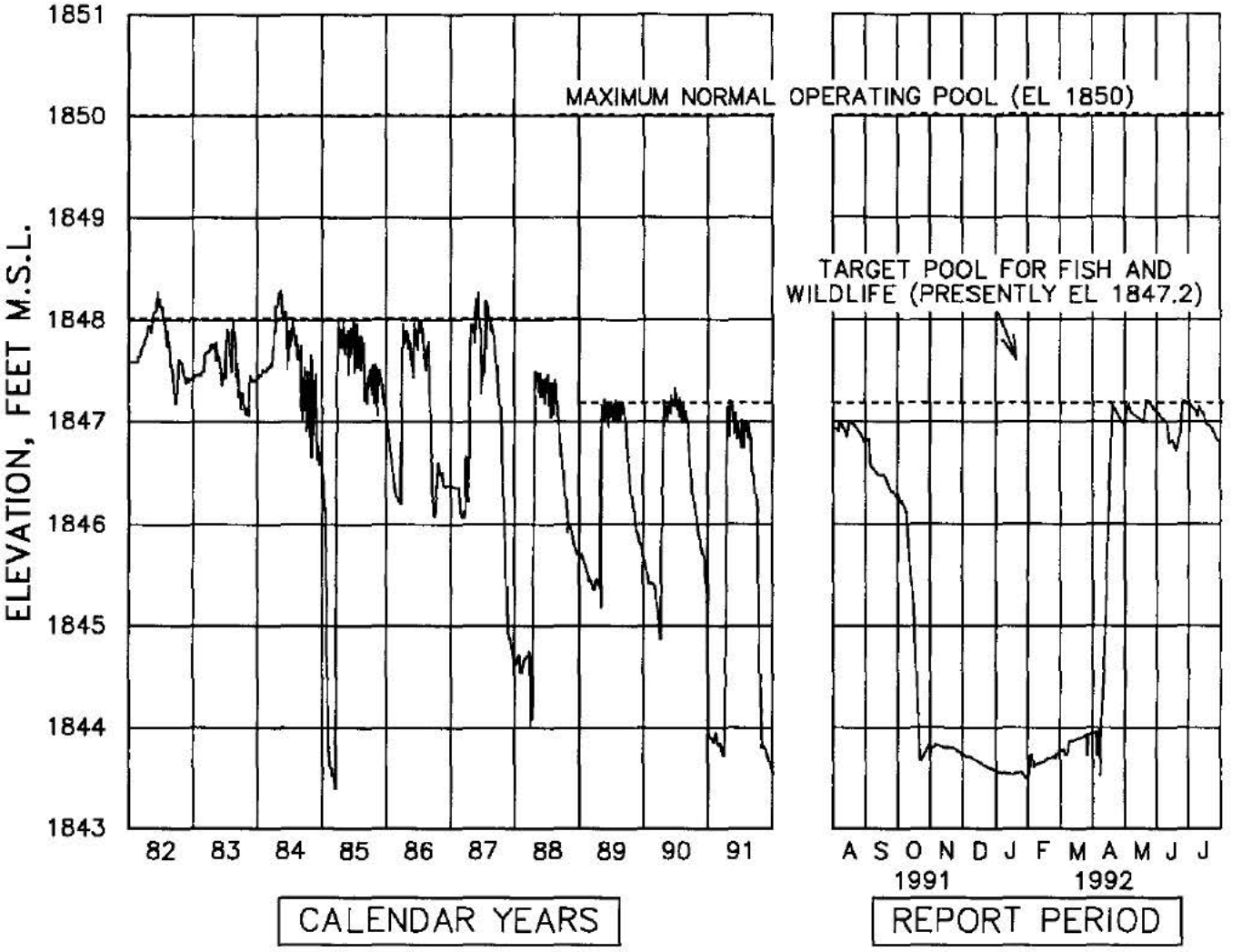
	Pool Date		**Pool Date**
Highest	1848.61 Apr 26 76	Lowest	1843.39 Mar 13 85
2nd	1848.57 May 21 79	2nd	1843.50 Jan 27 92
3rd	1844.02 Mar 29 88		

Report Period: (August 1, 1991 through July 31, 1992)

Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1847.20, May 20	1843.50, Jan 27

SNAKE CREEK DAM AND LAKE AUDUBON
LAKE SAKAKAWEA SUBIMPOUNDMENT
MISSOURI RIVER BASIN, NORTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



BOYSEN DAM AND LAKE
BIGHORN RIVER BASIN, WYOMING
1991-1992 REGULATION

Boysen Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone as per the Field Working Agreement dated May 5, 1967. When this occurs release determination is the responsibility of the Corps of Engineers (District Engineer).

The pool level did not enter the flood control zone during the report period and no releases were required for flood control.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	19,253 cfs Jun 23 67	14,204 cfs Jul 07 67
2nd	17,975 cfs Jun 17 63	10,688 cfs Jun 16 91
3rd	16,516 cfs Jun 15 91	8,518 cfs Jun 24 63

	Pool-Date
Highest	4730.83 Jul 06 67
2nd	4729.85 Jul 05 57
3rd	4729.18 Jun 16 91

Minimums of Record (since initial fill):

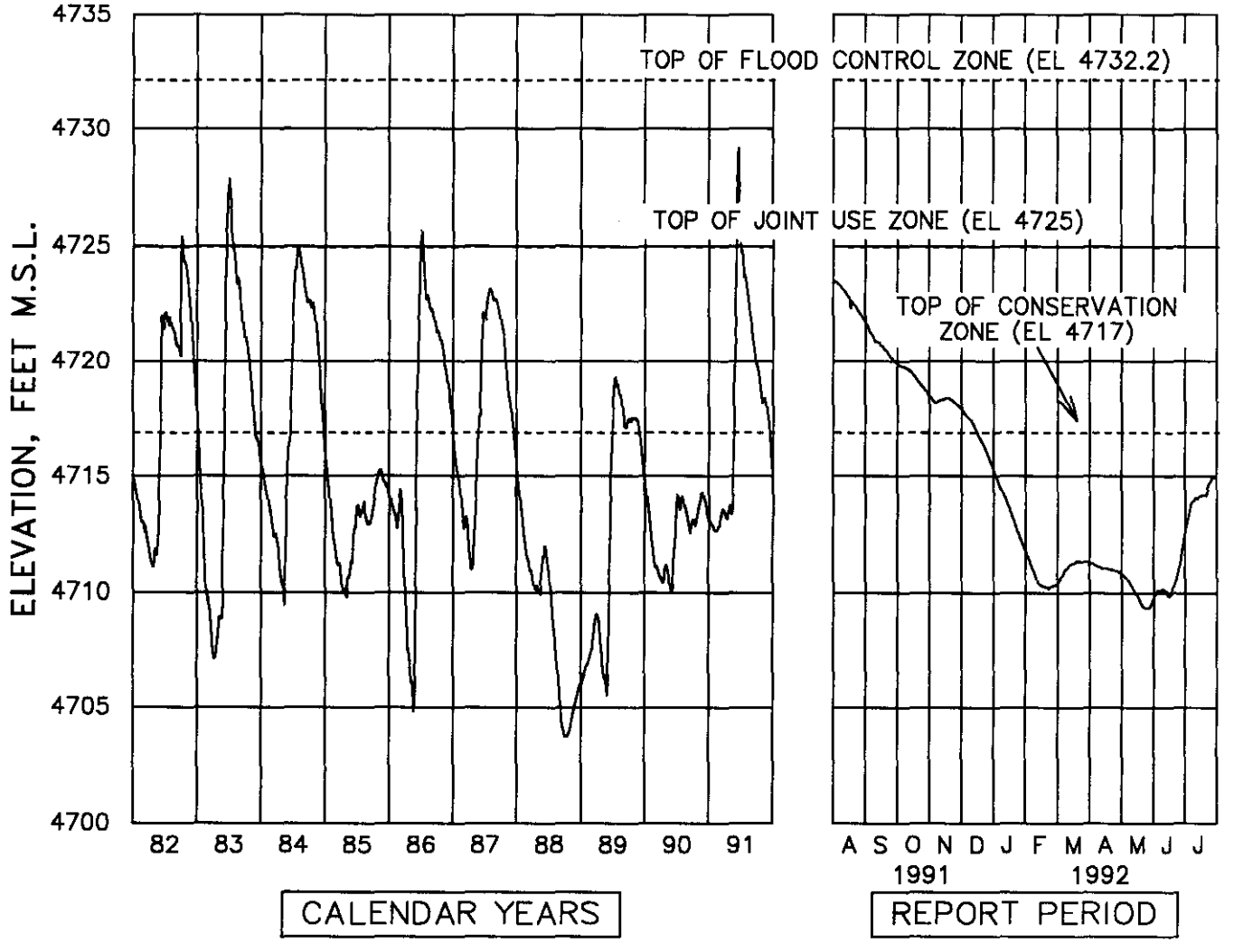
	Pool-Date
Lowest	4684.18 Mar 18-19 56
2nd	4686.42 Sep 21 60

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
672,350, 65% of normal	825,100, 80% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
4,016, Jun 27	1,607, Sep 17
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
4723.48, Aug 01	4709.35, May 25

BOYSEN DAM AND LAKE
BIGHORN RIVER BASIN, WYOMING
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



CANYON FERRY DAM AND RESERVOIR
MISSOURI RIVER BASIN, MONTANA
1991-1992 REGULATION

Canyon Ferry Reservoir is regulated by the Bureau (Regional Director) except when the pool level rises into the exclusive flood control zone or that portion of the joint use (conservation-flood control) zone required for flood control, as per the Field Working Agreement dated May 23, 1977. When this occurs, release determination is the responsibility of the Corps (District Engineer).

Inflow was insufficient to fill the joint-use zone. No flood control releases were made.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	29,050 cfs May 24 81	25,720 cfs Jun 13 81
2nd	27,570 cfs Jun 19 74	24,370 cfs Jun 19 64
3rd	27,110 cfs May 30 56	24,030 cfs May 31 56

	Pool-Date
Highest	3800.00 55, 56, 62
2nd	3799.93 Jul 7-12 75
3rd	3799.66 Jun 4-5 62

Minimums of Record (since initial fill):

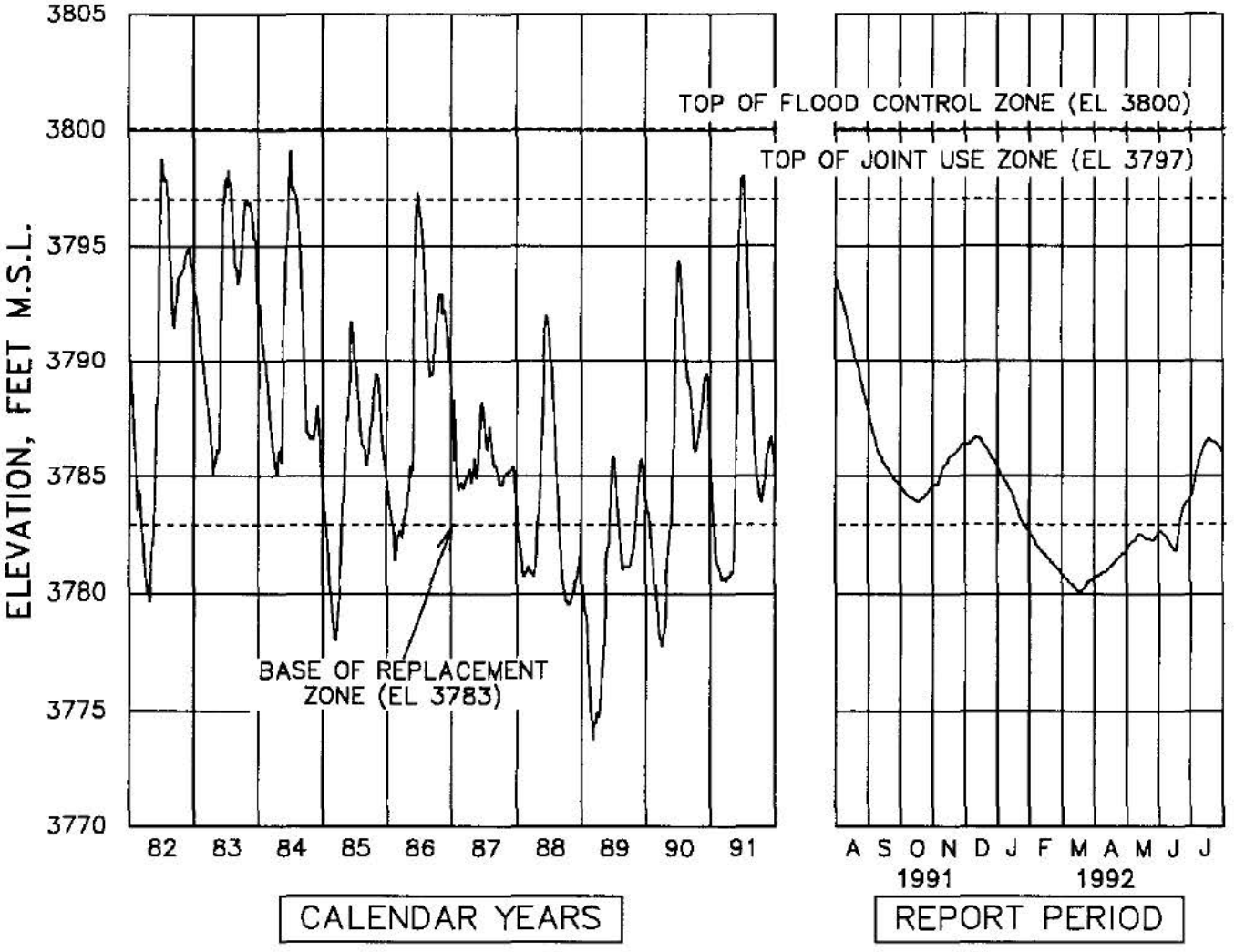
	Pool-Date
Lowest	3764.70 Apr 11 67
2nd	3772.75 Mar 25 62

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
3,152,900, 79% of normal	2,669,510, 67% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
8,311, Jun 19	4,583, Jan 29
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
3793.55, Aug 01	3780.08, Mar 15

CANYON FERRY DAM AND RESERVOIR
MISSOURI RIVER BASIN, MONTANA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



CLARK CANYON DAM AND RESERVOIR
BEAVERHEAD RIVER BASIN, MONTANA
1991-1992 REGULATION

Clark Canyon Reservoir (Hap Hawkins Lake) is regulated by the Bureau (Regional Director) except when the pool level rises into the exclusive flood control zone or that portion of the joint use (conservation-flood control) zone required for flood control, as per the Field Working Agreement dated November 19, 1971. When this occurs, release determination is the responsibility of the Corps (District Engineer).

Following the end of irrigation season in mid-September, releases to the East Bench Irrigation District were terminated. Wintertime releases were reduced to as low as 29 cfs in an attempt to conserve water. Inflow was barely sufficient to fill the conservation pool by the start of irrigation season in March. This was the first year since 1988 that the conservation pool has filled.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	3,416 cfs Jun 22 84	2,561 cfs Jun 25 84
2nd	2,800 cfs Jun 20 75	1,289 cfs Jul 31 75
3rd	2,208 cfs Mar 31 69	1,275 cfs Aug 12-24 75

	Pool-Date
Highest	5564.70 Jun 25 84
2nd	5556.88 Jul 22 75
3rd	5554.54 Jun 25 76

Minimums of Record (since initial fill):

	Pool-Date
Lowest	5508.67 Aug 23-25 89
2nd	5511.87 Aug 23 90

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
140,270, 49% of normal	152,050, 53% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
1280, Mar 31	821, Jun 11
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
5537.69, Apr 27	5517.40, Sep 07

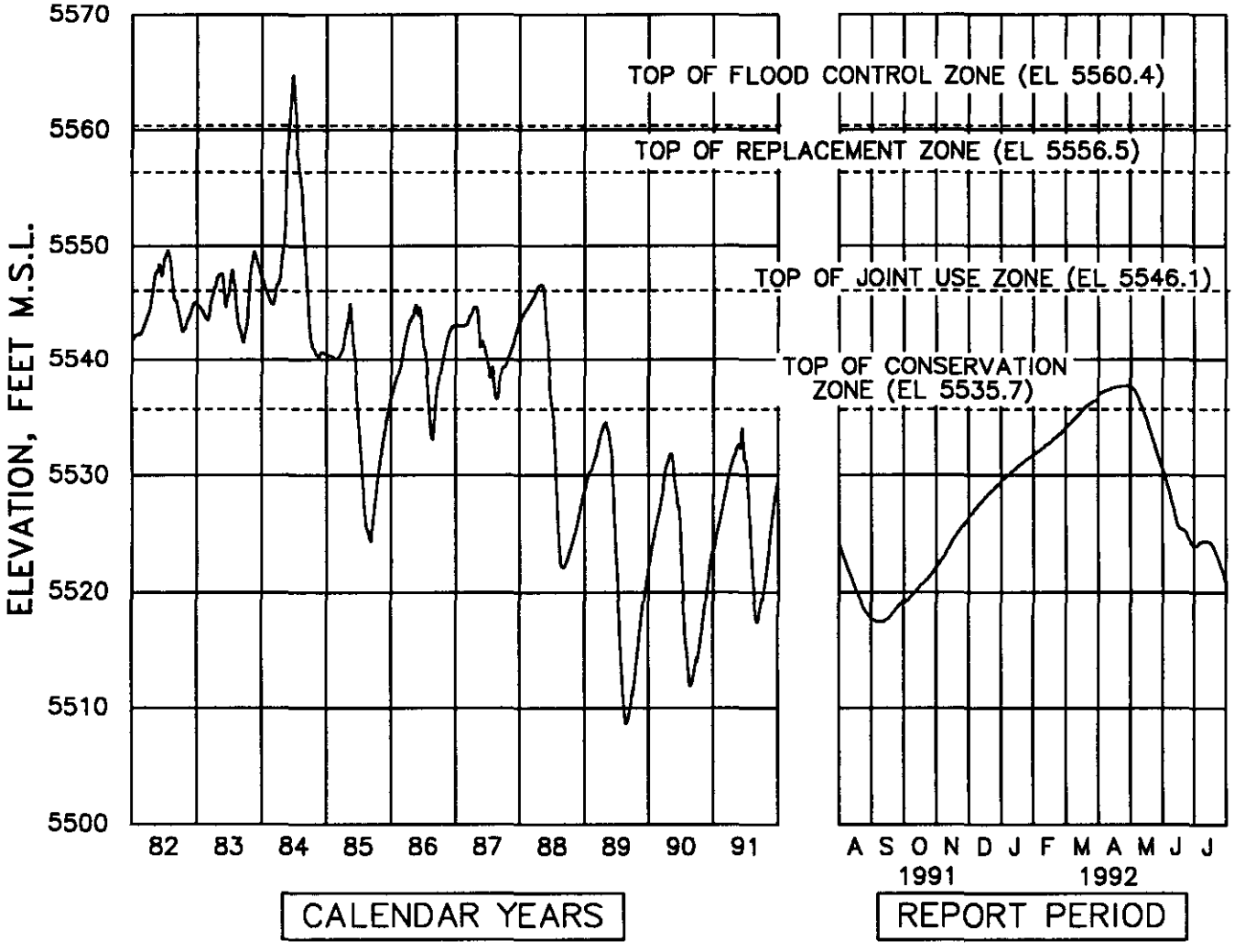
NON-CORPS PROJECTS

Regulated for flood control according to regulations in the Federal Register and supplemental agreements (between the Bureau of Reclamation and Corps of Engineers) in compliance with the 1944 Flood Control Act.

1. BOYSEN DAM
2. CANYON FERRY DAM
3. CLARK CANYON DAM
4. GLENDO DAM
5. HEART BUTTE DAM
6. JAMESTOWN DAM
7. KEYHOLE DAM
8. PACTOLA DAM
9. SHADEHILL DAM
10. TIBER DAM
11. YELLOWTAIL DAM

CLARK CANYON DAM AND RESERVOIR
BEAVERHEAD RIVER BASIN, MONTANA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



GLENDO DAM AND RESERVOIR
NORTH PLATTE RIVER BASIN, WYOMING
1991-1992 REGULATION

Glendo Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone. When this occurs, release determination is the responsibility of the Corps (District Engineer) as per the Field Working Agreement dated May 12, 1977. The bureau imposed an elevation restriction of 4650 ft. MSL in December of 1983 due to increased dike seepage. The final inspection was conducted on October 17, 1989. On February 16, 1990, the Bureau of Reclamation's Regional Office in Billings, Montana, officially rescinded Glendo Reservoir's operating restriction. The top of flood control pool is again at elevation 4653.

Glendo began the report period at elevation 4611.47 ft. MSL (19.27 feet higher than the beginning of the last report period). For the report period, inflows were 66 percent of average.

Glendo Reservoir pool did not enter the exclusive flood control zone during the report period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	18,840 cfs May 15 65	10,292 cfs Jun 30 84
2nd	17,560 cfs Jun 13 70	10,266 cfs Jul 01 84
3rd	14,661 cfs May 21 73	10,060 cfs Aug 26 83

	Pool-Date
Highest	4650.90 May 27 73
2nd	4650.27 Jun 14 83
3rd	4648.45 May 31 71

Minimums of Record (since initial fill):

	Pool-Date
Lowest	4548.10 Sep 28 66
2nd	4560.42 Sep 26 72

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)
810,081, 66% of normal

Total Outflow (AF)
780,116, 66% of normal

Peak Daily Inflow (CFS)
3396, Jul 18

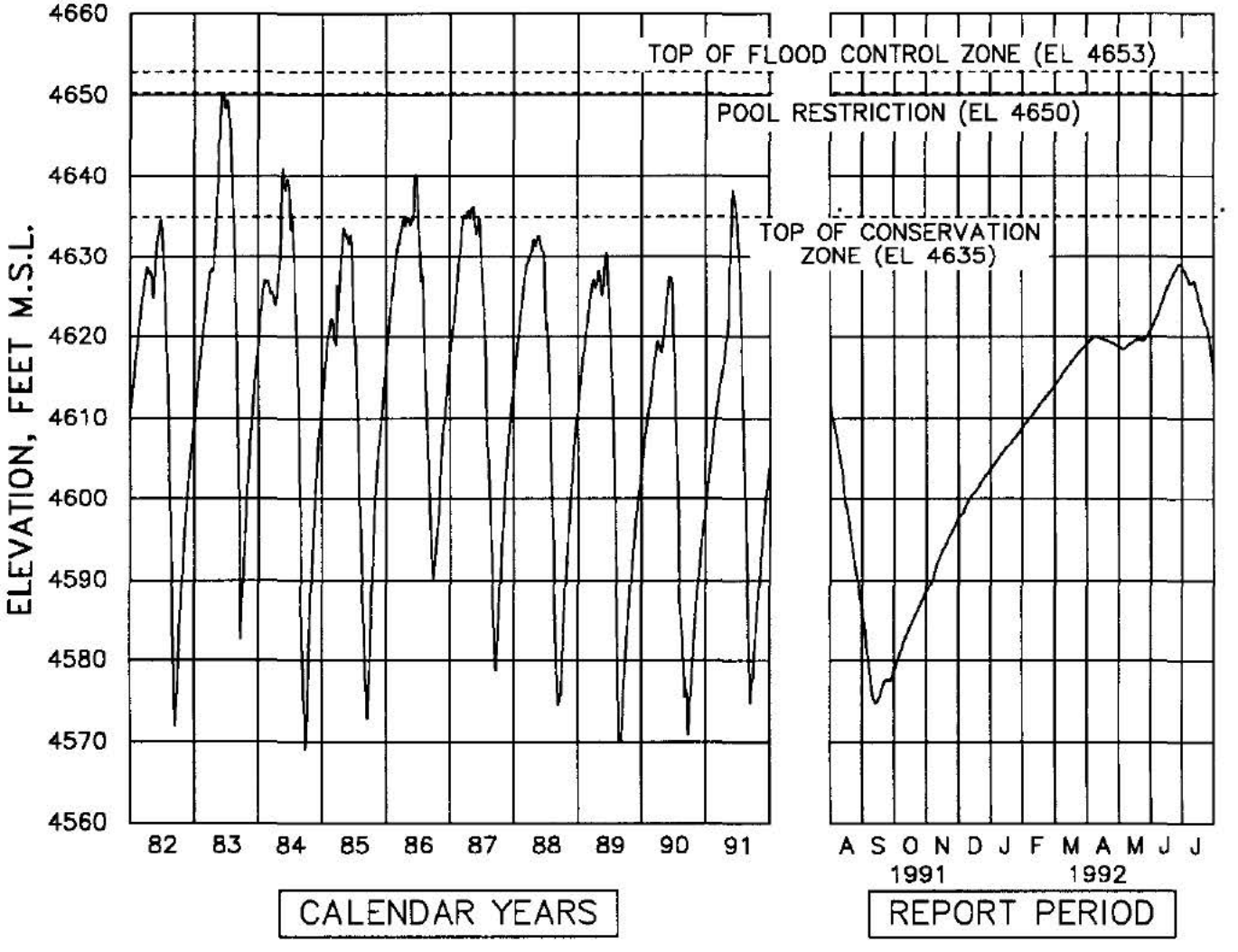
Peak Daily Outflow (CFS)
7471, Jul 26

Peak Pool Elevation (Ft. MSL)
4629.00, Jun 28

Minimum Pool Elevation (Ft. MSL)
4574.78, Sep 13

GLENDO DAM AND RESERVOIR
NORTH PLATTE RIVER BASIN, WYOMING
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



HEART BUTTE DAM AND RESERVOIR (LAKE TSCHIDA)
HEART RIVER BASIN, NORTH DAKOTA
1991-1992 REGULATION

Heart Butte Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone. When this occurs, release determination is the responsibility of the Corps (District Engineer) as per the Field Working Agreement dated Mar 15, 1951.

Due to extreme dry conditions throughout the Heart River Basin, record low pool elevations persisted.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	22,450 cfs May 09 70	4,050 cfs Apr 09 52
2nd	22,000 cfs Apr 17 50	3,931 cfs May 31 78
3rd	12,960 cfs Apr 06 52	3,864 cfs May 13 70

	Pool-Date
Highest	2086.23 Apr 09 52
2nd	2083.77 Mar 31 78
3rd	2082.70 May 12 70

Minimums of Record (since initial fill):

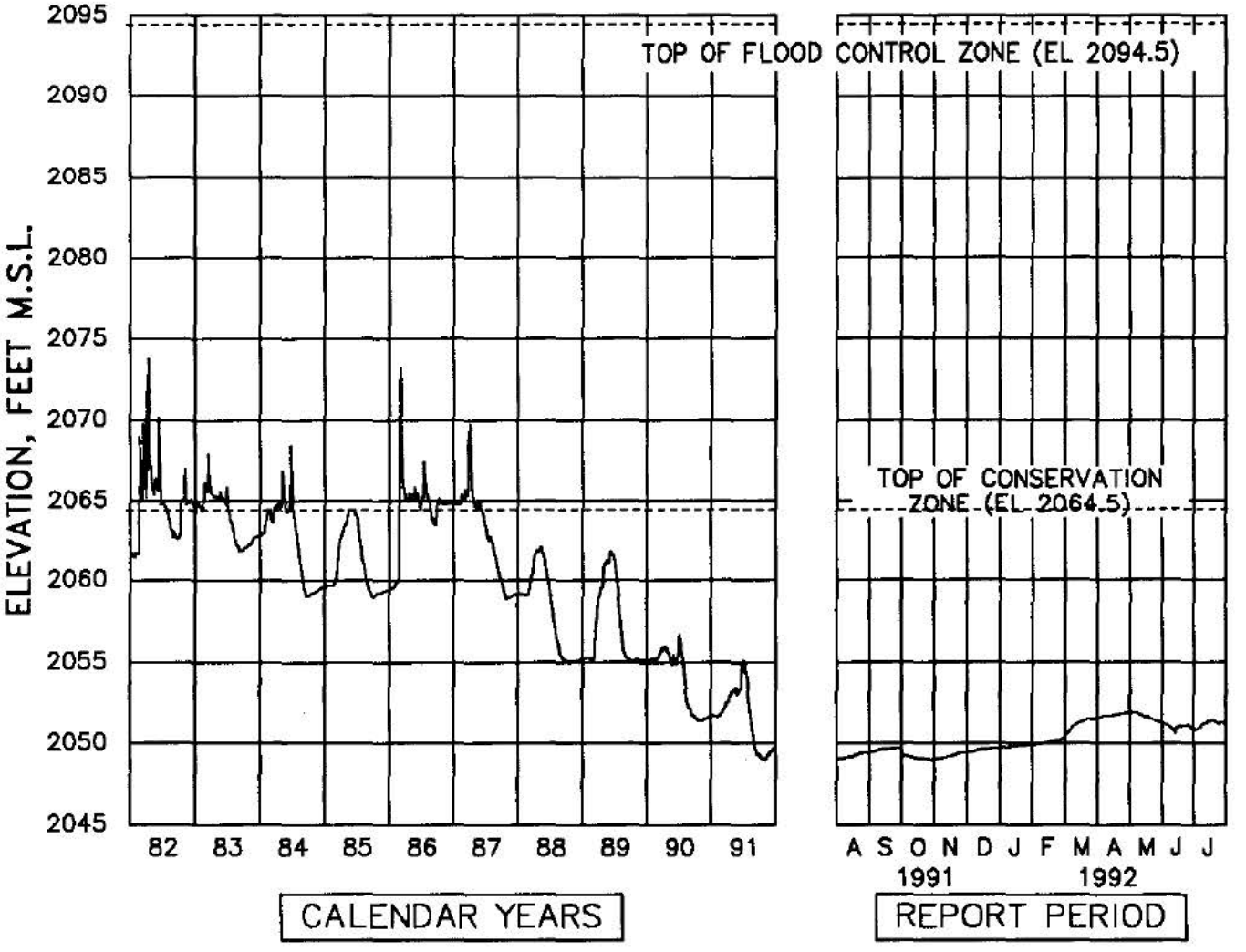
	Pool-Date
Lowest	2049.00 Oct 28 91
2nd	2051.44 Nov 07 90
3rd	2052.80 Dec 31 61

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
12451, 13% of normal	7378, 8% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
400, Jun 13	97, Aug 01
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
2051.95, May 01	2049.00, Oct 28

HEART BUTTE DAM AND RESERVOIR (LAKE TSCHIDA)
HEART RIVER BASIN, NORTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



JAMESTOWN DAM AND RESERVOIR
JAMES RIVER BASIN, NORTH DAKOTA
1991-1992 REGULATION

Jamestown Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone or that portion of joint use conservation-flood control zone required for flood control, as per the Field Working Agreement dated July 15, 1975. When this occurs, release determination is the responsibility of the Corps of Engineers (District Engineer).

Jamestown Reservoir pool elevation again steadily decreased over the reporting period. The minimum pool elevation and record low during the previous reporting period was the maximum pool elevation during the current reporting period (1423.50 feet above MSL). The new record low since initial fill was established July 27, 1992 at 1421.41 feet above MSL. The recorded precipitation for the reporting year was 13.49 inches. The average annual precipitation for Jamestown is 19 inches.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	7,220 cfs Apr 18 69	489 cfs Apr 16 83, 31
2nd	3,300 cfs Apr 04 87	400 cfs Mar, Apr, May 66 May, Jun, Jul 69
3rd	2,900 cfs May 03 79	370 cfs Apr 15-19 87

	Pool-Date
Highest	1444.10 Apr 27 69
2nd	1442.04 Apr 16 87
3rd	1440.90 Apr 01 73

Minimums of Record (since initial fill):

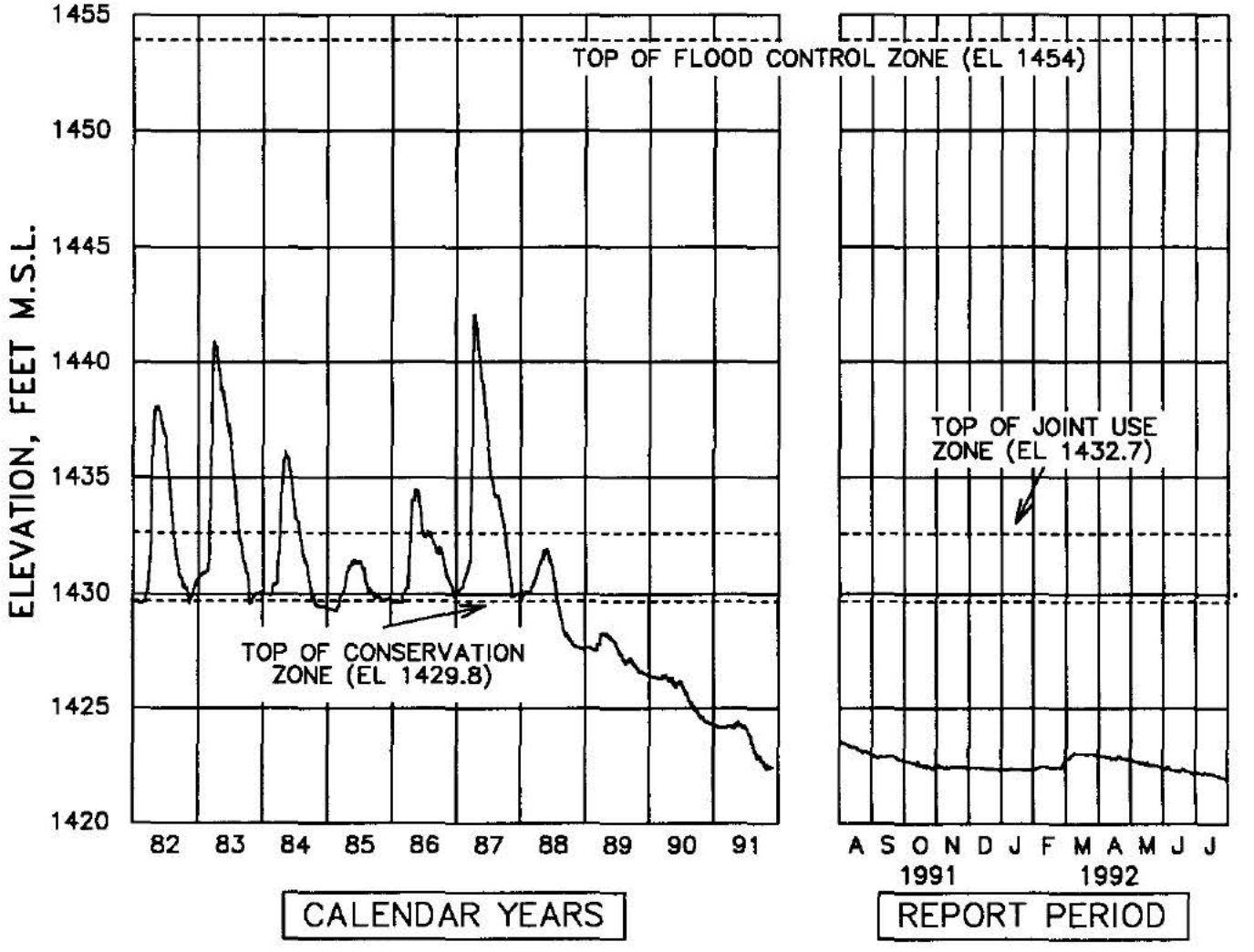
	Pool-Date
Lowest	1421.41 Jul 31 92
2nd	1423.53 Jul 31 91
3rd	1425.58 Jul 31 90
4th	1427.25 Jul 31 89

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
1836, 6% of normal	0
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
80, Feb 27	0
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
1423.50, Aug 01	1421.41, Jul 27

JAMESTOWN DAM AND RESERVOIR
JAMES RIVER BASIN, NORTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



KEYHOLE DAM AND RESERVOIR
BELLE FOURCHE RIVER BASIN, WYOMING
1991-1992 REGULATION

Keyhole Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone as per the Field Working Agreement dated February 11, 1970. When this occurs, release determination is the responsibility of the Corps of Engineers (District Engineer).

The pool elevation hit a record low of 4063.86 feet above MSL in July. This record low was approximately three feet lower than the previous low; a low that was set just one year earlier. Irrigation demands resulted in an pool elevation drop from 4073.91 feet on July 1 to 4066.93 feet on September 10.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	10,720 cfs May 19 78	1,347 cfs May 24 78
2nd	4,780 cfs Feb 29 72	820 cfs May 23-24 62
3rd	3,530 cfs Jun 18 62	801 cfs Mar 11-15 72

	Pool-Date
Highest	4100.38 May 07 78
2nd	4098.78 Mar 07 72
3rd	4096.41 May 06 73

Minimums of Record (since initial fill):

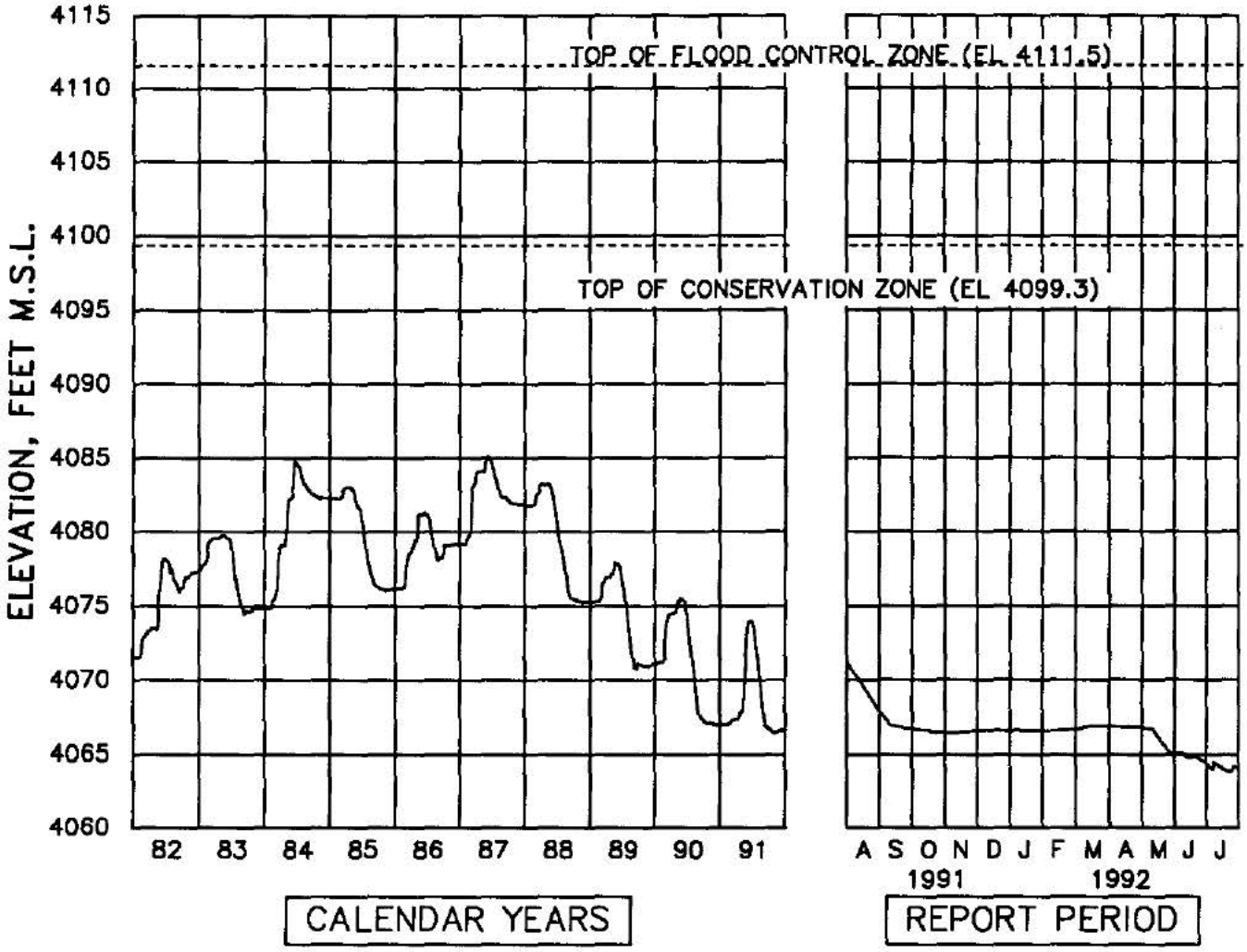
	Pool-Date
Lowest	4063.86 Jul 22-23 92
2nd	4066.94 Dec 12-22 90
3rd	4070.73 Sep 18 89
4th	4074.08 Jul 31 89

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
7,155, 22% of normal	16,990
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
449, Jul 07	134, Aug 01
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
4071.13, Aug 01	4063.86, Jul 22-23

KEYHOLE DAM AND RESERVOIR
BELLE FOURCHE RIVER BASIN, WYOMING
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



PACTOLA DAM AND RESERVOIR
RAPID CREEK BASIN, SOUTH DAKOTA
1991-1992 REGULATION

Pactola Reservoir is regulated by the Bureau (Regional Director) except when the pool level rises into the exclusive flood control zone. When this occurs, release determination is the responsibility of the Corps (District Engineer) as per the Field Working Agreement for this project dated August 27, 1969.

Precipitation and runoff during the reporting period was below normal. The pool level fluctuated a brief period during the months of March through May due to minor precipitation and runoff. Inflows to the project during the months of March, April and May were 145 percent, 51 percent and 45 percent of average respectively. In January a minimum release of 18 cfs was made in order to maintain downstream fisheries. Beginning in May storage was regulated in response to irrigation demands. No flood control was achieved during the period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	1,110 cfs May 16 65	500 cfs May 20 65
2nd	485 cfs May 11 78	350 cfs May 22 78
3rd	450 cfs Jun 07 91	255 cfs May 11 83

	Pool-Date
Highest	4585.87 May 19 65
2nd	4585.44 May 21 78
3rd	4585.06 Jan 22 72

Minimums of Record (since initial fill):

	Pool-Date
Lowest	4531.53 Jan 24 91
2nd	4533.12 Feb 21 90

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)
23300, 72% of normal

Total Outflow (AF)
22930, 78% of normal

Peak Daily Inflow (CFS)
85, May 10

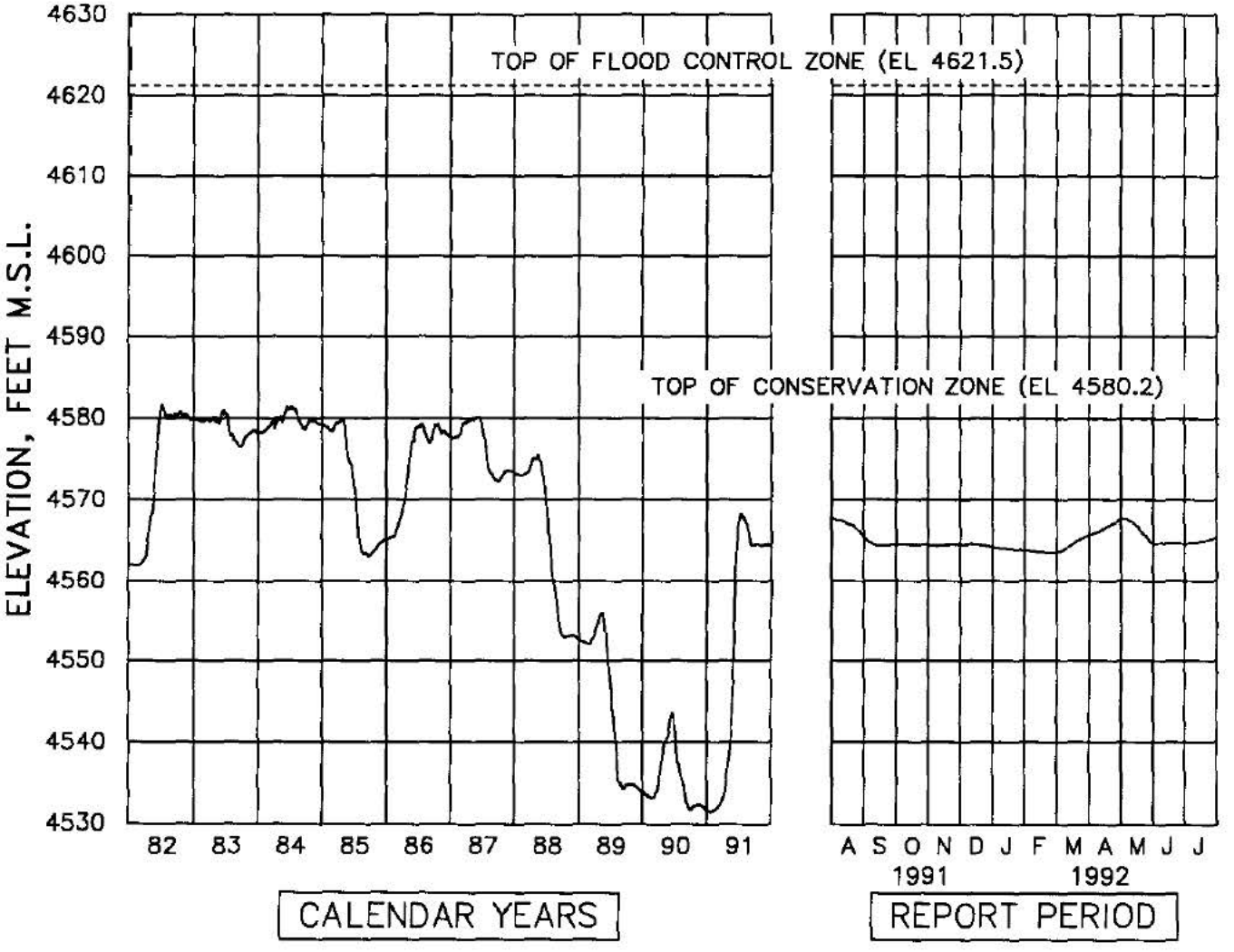
Peak Daily Outflow (CFS)
114, May 20

Peak Pool Elevation (Ft. MSL)
4567.77, Aug 01

Minimum Pool Elevation (Ft. MSL)
4563.62, Feb 21

PACTOLA DAM AND RESERVOIR
RAPID CREEK BASIN, SOUTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



SHADEHILL DAM AND RESERVOIR
GRAND RIVER BASIN, SOUTH DAKOTA
1991-1992 REGULATION

Shadehill Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone as per the Field Working Agreement dated May 15, 1972. When this occurs, release determination is the responsibility of the Corps of Engineers (District Engineer).

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	32,152 cfs Apr 08 52	5,078 cfs Apr 10 52
2nd	9,900 cfs Mar 29 78	4,190 cfs Apr 01 78
3rd	6,730 cfs Mar 13 72	3,020 cfs Mar 16 72

	Pool-Date
Highest	2297.90 Apr 10 52
2nd	2282.42 Apr 01 78

Minimums of Record (since initial fill):

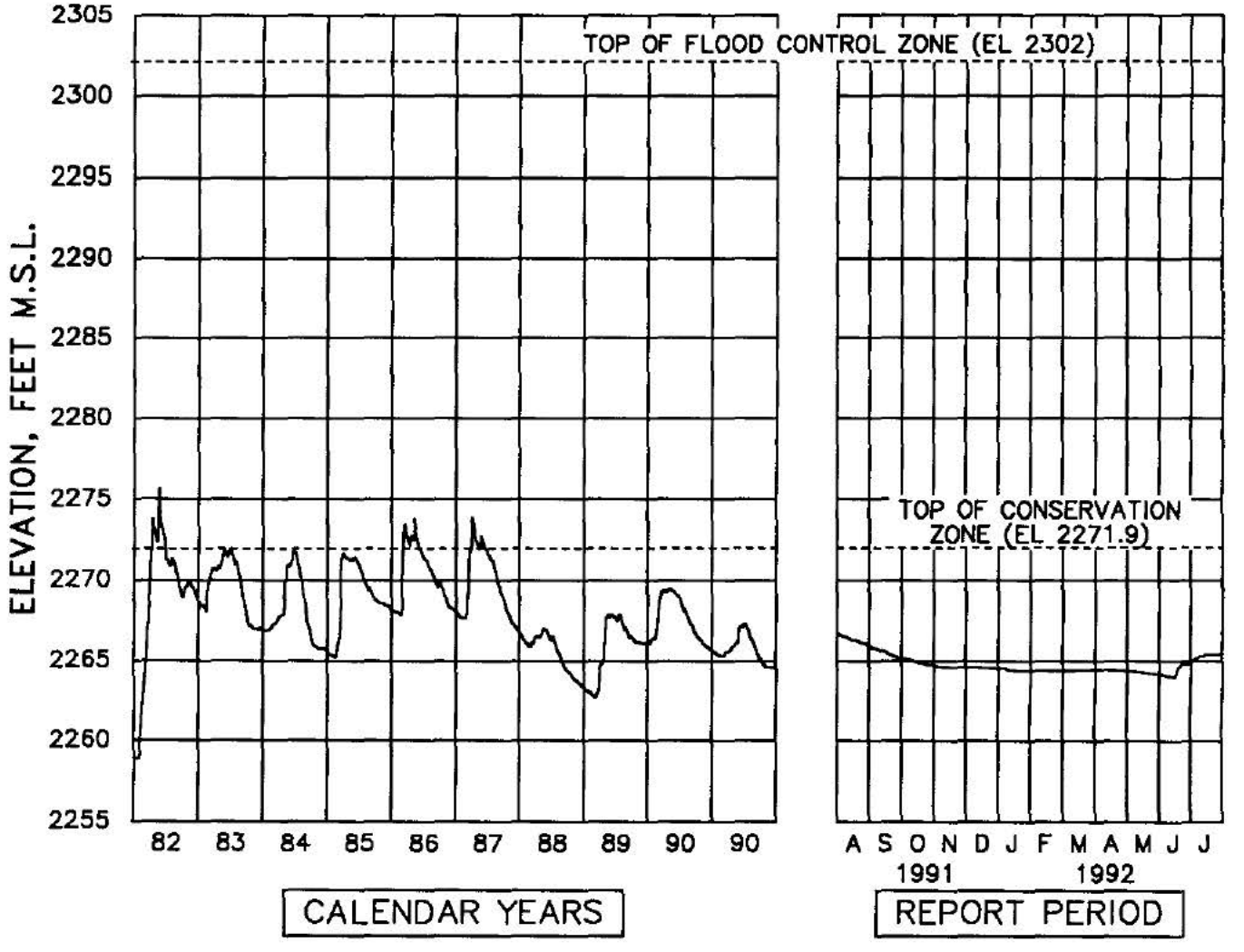
	Pool-Date
Lowest	2258.62 Nov 17 81
2nd	2259.11 Feb 28 62

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
20,129, 27% of normal	14,204
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
680, Jun 16	27, Aug 02
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
2265.92, Aug 01	2263.97, Jun 13

SHADEHILL DAM AND RESERVOIR
GRAND RIVER BASIN, SOUTH DAKOTA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



TIBER DAM AND RESERVOIR (LAKE ELWELL)
MARIAS RIVER BASIN, MONTANA
1991-1992 REGULATION

The Reservoir is regulated by the Bureau except when the pool level rises into the flood control zone or that portion of the joint use (conservation-flood control) zone required for flood control as per the Water Control Agreement. When this occurs, release determination is the responsibility of the Corps (District Engineer). When replacement storage is required for the downstream Fort Peck Reservoir, releases from Tiber Dam will be adjusted beginning Mar 1, based on anticipated inflow, to fill the reservoir to elevation 3008.1 ft. MSL prior to mid July. Minimum releases to achieve this fill are 300 cfs.

No water was stored for the purpose of flood control during the report period.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	102,888 cfs Jun 10 64	10,300 cfs Jun 13-14 64
2nd	53,053 cfs Jun 21 75	5,777 cfs Jun 25 75 Jul 11 75
3rd	25,200 cfs Feb 26 86	5,308 cfs Jun 22-24 67

	Pool-Date
Highest	3005.59 Jul 12 65
2nd	3001.91 Jun 13 64
3rd	2995.53 Jul 03 91

Minimums of Record (since initial fill):

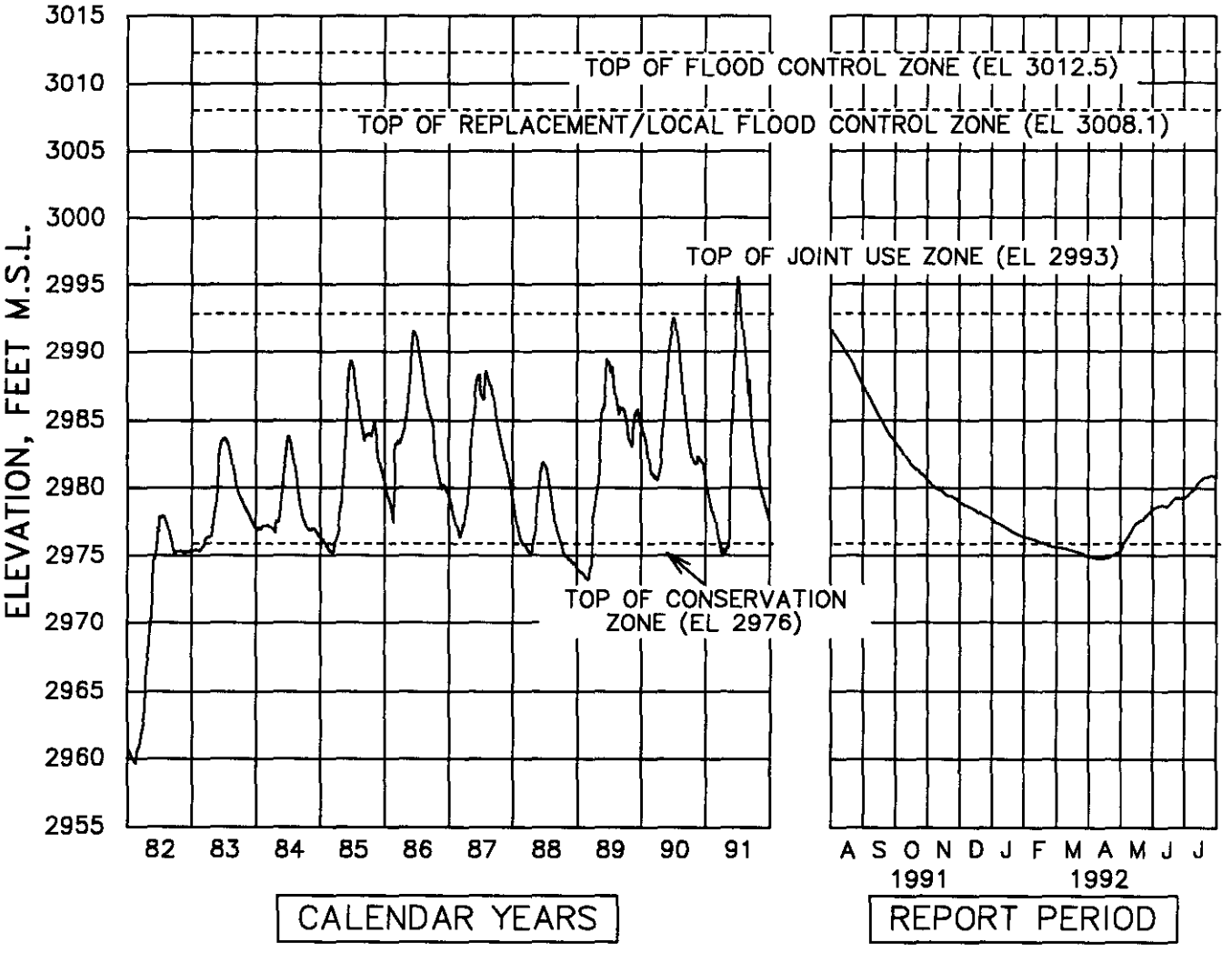
	Pool-Date
Lowest	2953.81 Mar 28 68
2nd	2955.31 Apr 27 67

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)	**Total Outflow (AF)**
350,170, 52% of normal	481,313, 78% of normal
Peak Daily Inflow (CFS)	**Peak Daily Outflow (CFS)**
1755, Jul 12	1573, Aug 24
Peak Pool Elevation (Ft. MSL)	**Minimum Pool Elevation (Ft. MSL)**
2991.61, Aug 01	2974.79, Apr 11

TIBER DAM AND RESERVOIR (LAKE ELWELL)
MARIAS RIVER BASIN, MONTANA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.



YELLOWTAIL DAM AND LAKE (BIG HORN LAKE)
BIG HORN RIVER BASIN, MONTANA
1991-1992 REGULATION

Yellowtail Reservoir is regulated by the Bureau of Reclamation (Regional Director) except when the pool level rises into the exclusive flood control zone (3640 ft. MSL) or that portion of the joint use zone required for flood control as per Field Working Agreement dated March 5, 1971. When this occurs, release determination is the responsibility of the Corps of Engineers (District Engineer).

Rainfall in early September resulted in a one foot encroachment into the flood control zone. Flood control releases of up to 4000 cfs evacuated this storage by the end of September.

As a result of spring runoff, the pool again entered the flood control zone in July. Peak flood control releases of 3400 cfs dropped the pool into the conservation zone by the first part of August.

Maximums of Record:

	Daily Inflow-Date	**Daily Outflow-Date**
Highest	29,775 cfs Jul 01 67	24,721 cfs Jul 08 67
2nd	19,005 cfs Jun 10 81	14,947 cfs Jul 03 70
3rd	18,607 cfs Jun 26 69	12,638 cfs Jun 12 91

	Pool-Date
Highest	3656.36 Jul 06 67
2nd	3648.55 Jul 13 78
3rd	3647.11 Jun 26 91

Minimums of Record (since initial fill):

	Pool-Date
Lowest	3583.30 Apr 14 89
2nd	3584.45 Mar 11 70

Report Period: (August 1, 1991 through July 31, 1992)

Total Inflow (AF)
2,061,000, 82% of normal

Total Outflow (AF)
2,014,320, 83% of normal

Peak Daily Inflow (CFS)
11,020, Jun 16

Peak Daily Outflow (CFS)
4,444, Oct 03

Peak Pool Elevation (Ft. MSL)
3641.92, Jul 27

Minimum Pool Elevation (Ft. MSL)
3612.51, May 06

YELLOWTAIL DAM AND LAKE (BIG HORN LAKE)
BIG HORN RIVER BASIN, MONTANA
1991–1992 REGULATION

A 10–year pool elevation hydrograph is shown below, with the current reporting period expanded for ease of reading.